Well Planning Workflow

HALLIBURTON | Landmark Software & Services

Halliburton | Landmark Software & Services
2107 CityWest Blvd, Building 2, Houston, Texas 77042-3051, USA
P.O. Box 42806, Houston, Texas 77242, USA
Phone:713-839-2000, FAX: 713-839-2015
Internet: www.halliburton.com/landmark

Trademarks

Note

Halliburton acknowledges that certain third party code has been bundled with, or embedded in, its software. The licensors of this third party code, and the terms and conditions of their respective licenses, may be found at the following location:

[Installdir]\Documentation\Third_Party.pdf

Contents

Well Planning Workflow

Software Applications Needed

- COMPASS™
- CasingSeat™
- StressCheck™
- WELLPLAN™
- WELLCAT™

Overview

The Well Planning Workflow is a typical workflow that might be used while planning a well. This workflow is not the only possible workflow that could be used during the planning phase, but rather is representative of a possible scenario.

This example workflow used in this section includes using the COMPASS, CasingSeat, StressCheck, WELLPLAN, and WELLCAT software in the following manner.

1. COMPASS software: This workflow begins in the COMPASS application. COMPASS software is used to create the data structure (Company, Project, Site, Well, Wellbore, and Design) to the design level. Two wellbores are created. The first wellbore is an actual Design. Survey data is imported to the actual Design as it would be during drilling. The second wellbore is a sidetrack from the first wellbore. On the sidetrack, targets are specified and the wellbore is planned using the COMPASS software. Anticollision analysis is briefly investigated.

2. CasingSeat software: Data structure input using COMPASS software is available to the CasingSeat application. Additional data required by CasingSeat software is input (pore pressure, fracture pressure, additional lithology data, design parameters, etc.). Using CasingSeat software, tentative casing shoes and sizes (Active Well Configuration) are determined.

3. StressCheck software: Casing shoes and sizes (Active Well Configuration) determined using CasingSeat software are available to the StressCheck application. StressCheck software is used to determine appropriate casing weights and grades to meet the demands of the downhole environment throughout the life of the well. After the analysis using the StressCheck software has been completed, the workflow can continue using the WELLPLAN software, or the WELLCAT software.

4a. WELLPLAN software: Torque drag and hydraulics analysis are performed using WELLPLAN software. There are many other analyses that could be performed using WELLPLAN software; however, this workflow focuses on torque drag and hydraulics analysis. The casing designs developed using StressCheck software are available in WELLPLAN software for use as drilling and run scenarios through the Create Case(s) from Casing Design feature.

4b. WELLCAT software: All modules (Drill, Prod, Tube, Casing, and MultiString) in the WELLCAT software are used. This workflow provides a guide through using each of these modules, allowing you to perform the analysis you require.

This workflow can be altered in many ways. Your analysis may require that you use the WELLCAT software to further explore thermal and pressure effects after you complete the casing design analysis using the StressCheck software. Or, you may want to use the WELLPLAN software to predict that hole cleaning will be a problem with the current wellpath. In this case, COMPASS software could be used to calculated another planned Design, which would require the use of CasingSeat and StressCheck software to redesign the casing.

This workflow does not demonstrate all the functionality of the software.

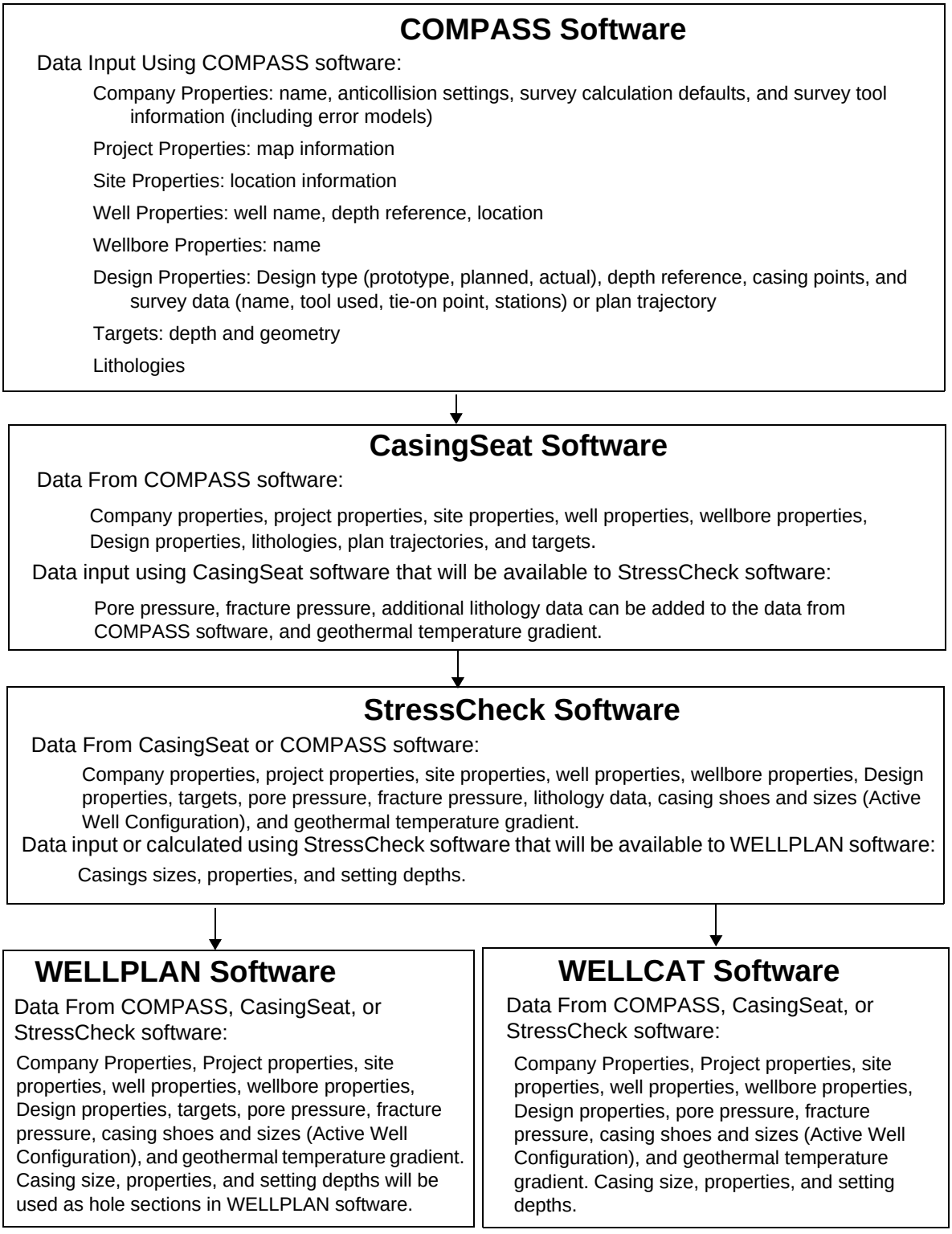
The intent of this workflow is to demonstrate integration between the applications and does not include all of the software's functionality. There are other possible ways the applications could be used together, as well as separately. Refer to the individual product's online help for more information.

Symbols Used in the Workflows

This symbol indicates data input in one application is shared with another application.

This symbol indicates important steps in the integration process.

Data Flow


COMPASS Software
Data Input Using COMPASS software:
Company Properties: name, anticollision settings, survey calculation defaults, and survey tool information (including error models)
Project Properties: map information
Site Properties: location information
Well Properties: well name, depth reference, location
Wellbore Properties: name
Design Properties: Design type (prototype, planned, actual), depth reference, casing points, and survey data (name, tool used, tie-on point, stations) or plan trajectory
Targets: depth and geometry
Lithologies
CasingSeat Software
Data From COMPASS software:
Company properties, project properties, site properties, well properties, wellbore properties, Design properties, lithologies, plan trajectories, and targets.
Data input using CasingSeat software that will be available to StressCheck software:
Pore pressure, fracture pressure, additional lithology data can be added to the data from COMPASS software, and geothermal temperature gradient.
StressCheck Software
Data From CasingSeat or COMPASS software:
Company properties, project properties, site properties, well properties, wellbore properties, Design properties, targets, pore pressure, fracture pressure, lithology data, casing shoes and sizes (Active Well Configuration), and geothermal temperature gradient.
Data input or calculated using StressCheck software that will be available to WELLPLAN software:
Casings sizes, properties, and setting depths.
WELLPLAN Software
Data From COMPASS, CasingSeat, or StressCheck software:
Company Properties, Project properties, site properties, well properties, wellbore properties, Design properties, targets, pore pressure, fracture pressure, casing shoes and sizes (Active Well Configuration), and geothermal temperature gradient. Casing size, properties, and setting depths will be used as hole sections in WELLPLAN software.
WELLCAT Software
Data From COMPASS, CasingSeat, or StressCheck software:
Company Properties, Project properties, site properties, well properties, wellbore properties, Design properties, pore pressure, fracture pressure, casing shoes and sizes (Active Well Configuration), and geothermal temperature gradient. Casing size, properties, and setting depths.

Workflow Steps

COMPASS User Workflow

1. Launch COMPASS software (**Start > Programs > Landmark's Engineer's Desktop 5000.0.0 > COMPASS**).

2. Enter the appropriate User ID and Password on the login screen.

Create Company

3. Create a new company. From the Well Explorer, right-click on the database level, and select **New Company** from the drop-down menu.

4. Specify Company properties.

   a) Select the **Company Properties > General** tab then name the company.

Specify Anticollision Settings

   b) Select the **Company Properties > Anticollision** tab then specify the anticollision parameters.

   c) Select the **Company Properties > Calc Defaults** tab then specify the calculation defaults.

   d) Click **OK** to create the company.

5. Do not create a new project when prompted.

Define Survey Tools

6. Define survey tools.

   a) From the Well Explorer, right-click on the company you created, and select **Survey Tools** from the drop-down menu.

   b) Use the **Survey Tools** dialog to create a survey tool, or click the Import button to import tool data from a file. Click the **Default Tool** box to use the highlighted as the default survey tool.

c) Click **Save** to save the tool.

d) Import or create additional tools as needed.

Create a Project

7. Select **File** > **New** > **Project** to create a new project.

a) Select the **Project Properties** > **General** tab to specify project properties.

b) Select the **Project Properties** > **Map Info** tab to specify map information.

Create a Site

8. Create a new site when prompted by clicking the **Yes** button.

a) Select the **Site Properties** > **General** tab to specify general site information.

b) Select the **Site Properties** > **Location** tab to specify the site location.

Create a Well

9. Create a new well when prompted by clicking the **Yes** button.

a) Select the **Well Properties** > **General** tab to specify general well information.

b) Select the **Well Properties** > **Depth Reference** tab to specify the well depth reference, configuration (offshore or onshore), and to view a depiction of the datum.

c) Select the **Well Properties** > **Location** tab to specify the location of the wellhead.

Create a Wellbore

10. Create a new wellbore when prompted.

a) Select the **Wellbore Properties** > **General** tab to define general information about the wellbore.

Create an Actual Design

11. Create an actual Design for the wellbore when prompted.

Create a New Survey

12. Create a new survey when prompted.

    a) Select the **Survey Properties** > **General** tab, name and specify information about the survey.

    b) Select **Survey Properties** > **Tie-on** tab, specify the tie-on point of the survey. Close the dialog.

13. Import or manually enter survey data.

    a) Click on the **Import** toolbar button to import the survey file, or enter the survey data manually.

    b) Save the survey after it is imported or the data is manually entered.

    c) Update the survey program with this survey.

    d) Close the Survey Editor.

Create a Sidetrack

14. This example has a sidetrack. If there isn't a sidetrack, skip this step. To create a sidetrack:

    a) From the Well Explorer, right-click on the well level and select **New Wellbore** from the menu.

    b) Name the wellbore, and indicate the **Parent Wellbore** of the sidetrack.

    c) Specify any additional data pertaining to the sidetrack on the remaining **Wellbore Properties** tabs.

    d) Click **OK** to create the sidetrack and close the dialog.

    e) Do not create a new plan when prompted.

Create a Target

15. Right-click on the sidetrack wellbore you created, and select **Targets** to access the **Target Editor**. Use the **Target Editor** to define the targets for the wellbore. You can access the Target Editor for the site by right-clicking on the project, and selecting **Targets** from the menu.

    a) Select the **Name & Location** tab to define the name, TVD, and center location of the target.

    b) Select the **Geometry** tab to define the target geometry.

    c) If the target was created at the wellbore level, it will automatically be assigned to the wellbore. If the target is created at the project level, assign the target to the wellbore by clicking the **Wellbore List** toolbar button and then checking the box associated with the target.

    d) Close the Target Editor dialog.

Create a Plan

16. Create a plan.

    a) From the Well Explorer, right-click on the sidetrack wellbore and select **New Plan** from the menu. Name the plan and select the depth reference.

    b) Select the **Plan Design Properties** > **Tie-on** tab, specify the tie-on point.

    c) Select the **Plan Design Properties** > **Vert Section** tab, specify the vertical section information.

17. Use the Plan Editor to specify the plan. Save and close the plan after it is created.

Specify Formation Tops

18. To specify formation tops, right-click on the planned Design in the Well Explorer. Select **Formations** to access the **Design Formations Top Editor**. You can also access this editor using the Well Explorer by right-clicking on the planned Design and selecting **Formations** from the menu.

Specify Casing Points

19. Specify tentative casing points. (Note: These casing points can be revised later in the design process using CasingSeat and StressCheck software.) Right-click on the planned Design in the Well Explorer and select **Casings** to access the Design Casings Editor. You can also access this editor using the Well Explorer by right-clicking on the planned Design and selecting **Casings** from the menu.

Perform Anticollision Analysis

20. Perform anticollision analysis.

    a) Select **Analysis > Select Offset Designs** and specify offset Designs for anti-collision analysis.

21. Select **Plot > Ladder View** and review anticollision risk.

22. Lock the planned Design. To lock the Design, check the Design is Locked box on the **Plan Design Properties > General tab**.

23. Leave COMPASS software open while you start the next step of the workflow.

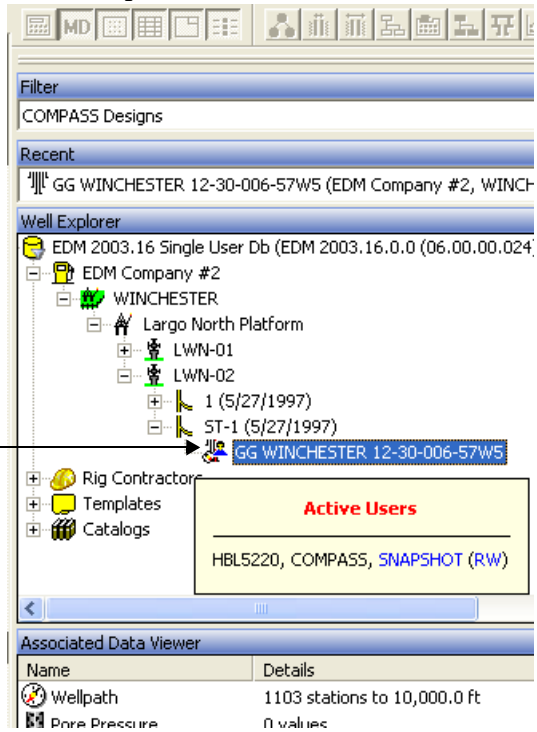
> **WARNING!**
>
> A reload notification dialog appears when the owner of the active data item saves changes to the database. SAM then notifies any other EDM applications of the changes. The change notification dialog is then offered to the user to reload or ignore the data owner's changes or cancel the dialog box. The dialog that appears displays the user name for the owner as well as the application in which the changes were made. This enables the user to identify the source of the posted change. It is highly recommended to contact the other person who is working with the same data in order to coordinate work in the Design/Case.
>
> For further details, see the *Simultaneous Activity Monitor (SAM)* topic in application Help.

CasingSeat User Workflow

24. Launch CasingSeat software (**Start > Programs > Landmark Engineer's Desktop 5000.0.0 > CasingSeat**). Notice that you were not required to log in because COMPASS software is still open.

25. Move the cursor over the planned Design icon that you were using in the COMPASS application. Notice the message displayed indicates that the plan is already open using another application. Notice the blue SAM icon indicating that this plan Design is already open on this computer. In this case, the current user has full access to the plan - unless the plan is locked.

Notice the blue SAM icon. Refer to the online help for more information about SAM.



26. From the Well Explorer, double-click on the planned Design to open the Design. The following message displays. Click **OK**, but then click **Cancel** when the **New** dialog displays.

27. From the COMPASS application, unlock the planned Design to update the Design using CasingSeat software. (Unlock the Design using the **Planned Design Properties** dialog.) Alternatively, you could save the Design using a different name as the previous step indicated. If you are working alone on this Design, you would probably not want to save it as a new Design. If you are working with other individuals on the Design, you may consider saving to a

new name prior to updating the Design so that each individual working on the Design has their own copy of it.

Open a Design

28. From the Well Explorer, double-click on the planned Design to open the Design. Notice the message indicating the Design is locked was not displayed this time.

29. When you open the Design, you will be asked what template you want to apply to the Design. Apply the template of your choice. Only templates listed in the ..\Landmark\EDT_5000.0.0\CasingSeat\Client folder are included in the list.

Review the Well Depth

30. Verify the well depth using the **Well > General** dialog. You can also access this dialog using the Wizard.

Review Wellpath Data

31. Verify the wellpath represents the planned Design from the COMPASS application using the **Well > Wellpath Editor**. You can also access this dialog using the Wizard.

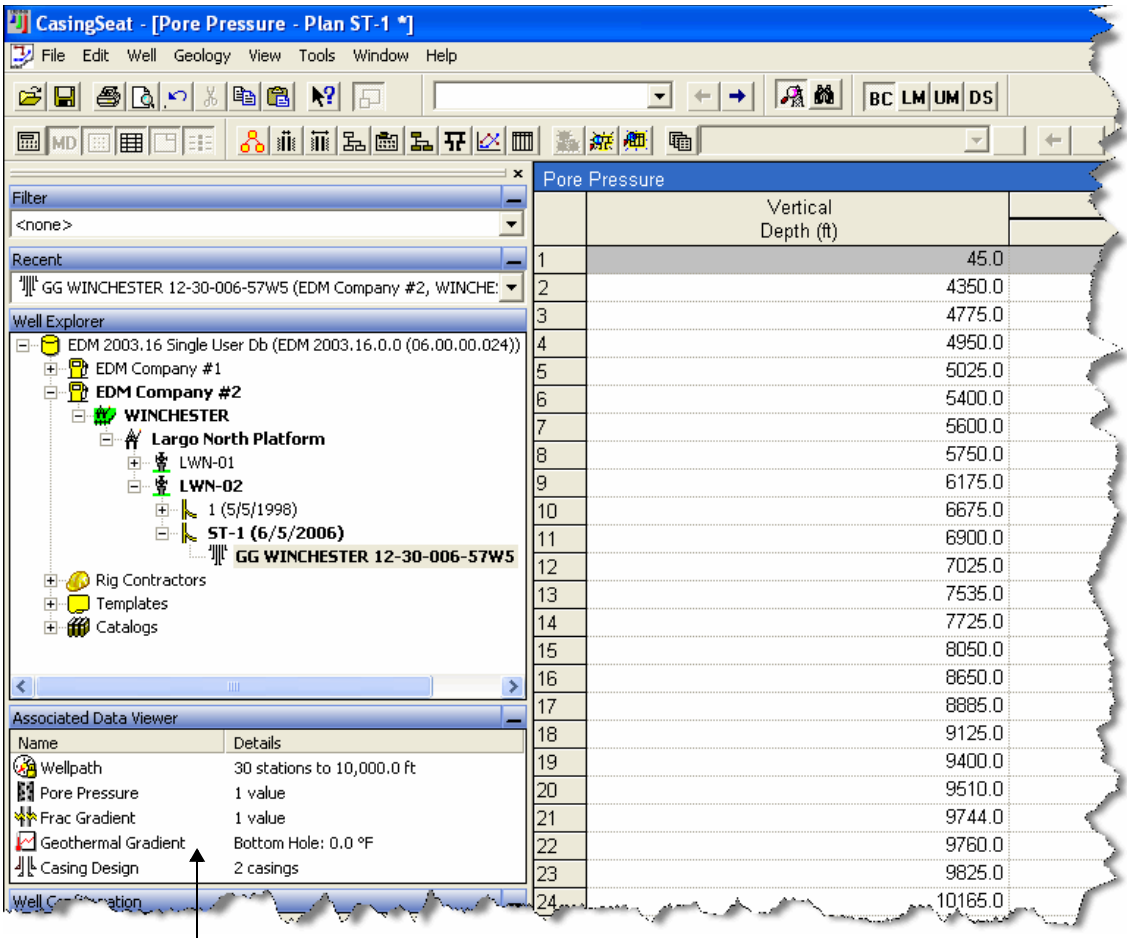
Specify Design Parameters

32. Specify design parameters using the **Well > Design Parameters** tabs.

Specify Pore Pressure Data

33. Specify pore pressure data using **Geology > Pore Pressure**. You can enter this data, cut/paste it from a spreadsheet, or copy it from another Design.

When the asterisk (*) is displayed, it means that the data has changed, but has not been saved. Use **File > Save** to save the data.



Notice that the **Associated Data Viewer** is not updated until you save the Design.

Specify Fracture Gradient Data

34. Enter fracture gradient data into **Geology > Fracture Gradient.** You can enter this data, cut/paste it from a spreadsheet, or copy it from another Design.

Update Lithology Data

35. Update the lithology information using **Geology** > **Lithology**.

Specify Geothermal Gradient

36. Specify geothermal gradient information using **Geology** > **Geothermal Gradient**.

Specify Drilling Parameters

37. Specify the drillpipe OD, BHA OD, and BHA Length using the **Well** > **Drilling Parameters** spreadsheet.

Calculate Results

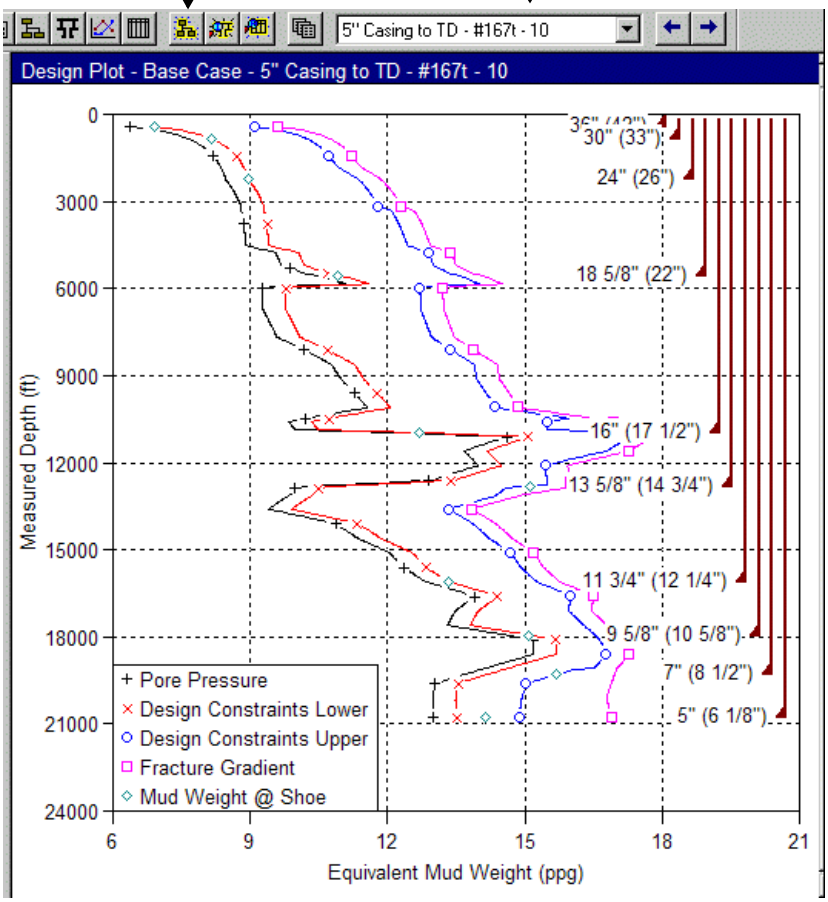
38. Select **View** > **Calculate** to Calculate results. Use defaults for all calculation parameters.

Review Results and Select Active Configuration

39. After results have been calculated, review design plots using **View** > **Design Plot**. Select the scheme you want to use further in the analysis from the **Casing Scheme Selection** list. Set this configuration as the active well configuration.

Click **Set Active Well Configuration** toolbar button to select the active Design as the one you want to use.

Select the desired casing scheme using the **Casing Scheme Selection** drop-down list.



40. Select **File > Save** to save the Design. Close CasingSeat and COMPASS software if they are still open.

SAM Reload Notifications

If COMPASS software or another application is open while saving changes in the CasingSeat application, the Reload notification displays.

For further details, see the *Simultaneous Activity Monitor (SAM)* topic in application Help.

StressCheck User Workflow

41. Launch StressCheck software (**Start > Programs > Landmark Engineer's Desktop 5000.0.0 > StressCheck**). You will need to log if another EDM™ software application is not open.

Open a Design

42. From the Well Explorer, double-click on the planned Design to open it or right-click on the planned Design and select **Open** from the drop-down menu. Select the desired template.

Verify the Well Depth

43. Verify the well depth using the **Wellbore > General** dialog. You can also access this dialog using the Wizard.

Review Pore Pressure, Fracture Gradient, and Geothermal Gradient

44. Using **Wellbore > Pore Pressure**, **Wellbore > Fracture Gradient**, and **Wellbore > Geothermal Gradient** verify the data is the same as what you entered using CasingSeat software. You can open these spreadsheets and dialog by double-clicking on them in the **Associated Data Viewer**.

Review Wellpath Data

45. Using **Wellbore > Wellpath Editor**, verify the data is the same as it was in the COMPASS software.

Specify Dogleg Severity Overrides

46. Use **Wellbore > Dogleg Severity Overrides** to define intervals of wellpath curvature independent of the deviation profile defined using **Wellbore > Wellpath Editor**.

Define Default Bit Sizes

47. Use **Tools > Defaults > Bit Sizes** to add additional bit sizes as required.

Update Casing and Tubing Scheme to Include Liners and Tubing

48. In order to use liners and tubing in the Design, update the **Wellbore > Casing and Tubing Scheme** spreadsheet.

Specify Packer Fluid and Placement

49. Specify packer fluid and placement using **Wellbore > Production Data**.

Select String to Design

50. Select the casing string you want to design.

Specify Design Factors

51. Specify the design factors and analysis options for designing the casing and/or tubing using the **Tubular > Design Parameters** dialog.

Define Load Cases

52. Review the post-cementing hydrostatic profiles for certain burst, collapse, and axial loads using **Tubular > Initial Conditions**.

53. Specify the burst loads for the casing and/or tubing using **Tubular > Burst Loads**.

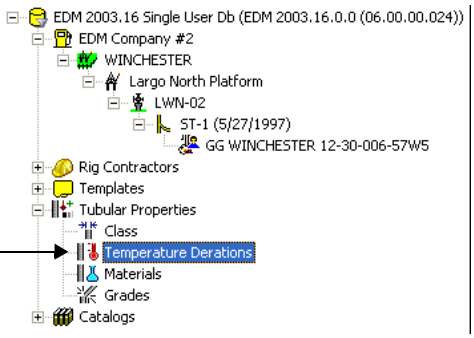
54. Specify collapse loads for the casing and/or tubing using **Tubular > Collapse Loads**.

55. Specify the axial loads using **Tubular > Axial Loads**.

Define Tubular Properties

56. From the Well Explorer, define temperature derations schedules, if required.

Double-click on **Temperature Derations** in the Tubular Properties section of the Well Explorer to access the Temperature Derations spreadsheet.



57. Use the Well Explorer to define materials, if required. Access of the Materials spreadsheet is similar to accessing the Temperature Derations spreadsheet.

58. Use the Well Explorer to define tubular grades, if needed. Access of the Grades spreadsheet is similar to accessing the Temperature Derations spreadsheet.

Review and Update Pipe Inventory

59. Use **Tubular** > **Pipe Inventory** to define additional pipes needed that are not in the inventory.

Specify String Configuration

60. Select **Tubular** > **String Sections** to specify the string configuration.

61. Select **Tubular** > **Special Connections** to define tubing connections not already defined in the **Tubular** > **Connections** spreadsheet.

62. Select **Tubular** > **Connections** to specify the connections for the string section.

Perform Triaxial Design Check

63. Determine if tubing is appropriately designed by reviewing triaxial design limits using **View** > **Triaxial Check** > **Design Limits**.

Triaxial design limits are met when all load lines are within the envelope.

Save the Design

64. Select **File** > **Save** then close the StressCheck application.

65. Verify the casing information in the COMPASS application. Remember, in an earlier step tentative casing points were entered into COMPASS software. Now that casing design has been performed using CasingSeat and StressCheck software, the casing points in the COMPASS application are revised. From the Well Explorer, right-click on the design level and select **Casings**. Notice the casings displayed are those that were designed using CasingSeat and StressCheck software. Close the COMPASS application.

Note: After completing the StressCheck™ software workflow steps, you have the option to use either the WELLPLAN™ software or the WELLCAT™ software to complete the workflow depending on your analysis requirements.

To Complete the Workflow Using the WELLPLAN™ software:

Continue with Step 66a on the next page.

To Complete the Workflow Using the WELLCAT™ software:

This workflow begins with Step 66b on page 29. The WELLPLAN software workflow steps (Steps 66a through 94a on pages 23 - 28) are not performed.

WELLPLAN User Workflow

66a. Launch WELLPLAN software (**Start > Programs > Landmark Engineer's Desktop 5000.0.0 > WELLPLAN**). Login if needed.

Create Case from a Casing Design

67a. From the Well Explorer, right-click on **Design** icon, then select **Create Case(s) from Casing Design**. from the drop-down menu. The Create Case(s) from Casing Design dialog displays.

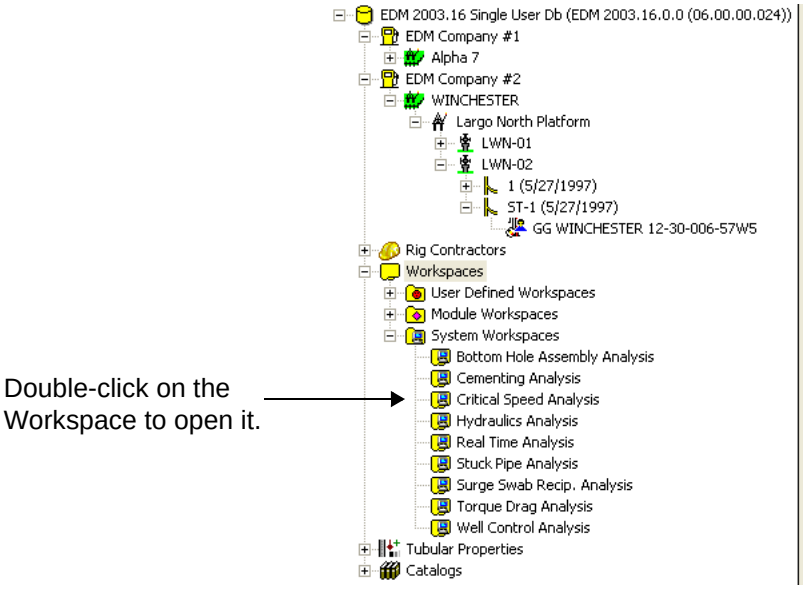
68a. If this is a Subsea wellbore and a Riser is desired, enter **Outer Diameter** and **Inner Diameter** dimensions.

69a. Select the scenario option for each casing scheme. See the information below for details about the rules and logic behind each scenario. Use the **Select All** and **Unselect All** buttons as needed. Click **Finish** when all scenarios are selected to create the Case(s).

> **Drilling and Run Scenarios**
>
> For details about the rules and logic behind Drilling and Run Scenarios, see the *Simultaneous Activity Monitor (SAM)* topic in application Help.

Apply System Workspace

70a. From the Well Explorer, double-click on a **System Workspace** to activate that workspace. Notice the tabs that appear in the bottom of the work window after the template is opened.

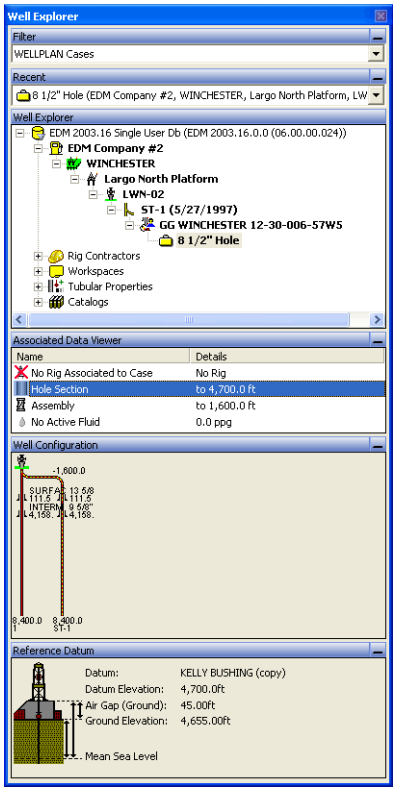


Select Casing String Designed Using StressCheck as Hole Section

71a. Select the casing string designed using StressCheck software as the hole section you want to use.

a) Open the Hole Section Editor by using **Case > Hole Section Editor** or by double-clicking on the Hole Section item in the **Associated Data Viewer**.

Double-click on **Hole Section** in the **Associated Data Viewer** to open the Hole Section Editor. You can open the String Editor and Fluid Editor in the same way.



b) Click the **Copy String** button on the Hole Section Editor to access the strings designed using StressCheck software. Click **OK** when the message indicating that copy is not reversible appears.

c) Select the string you want to use from the **Select String to Copy to Hole Section Editor** dialog.

d) Specify the hole section depth. (This includes any open hole section that wasn't included in the copy from the StressCheck application.) Update the friction factors and other data as desired.

Enter or Import the Work String

72a. Select **Case > String Editor** to open the String Editor or double-click on the **Assembly** item in the **Associated Data Viewer**. Specify string data as needed. To save time, you can copy/paste strings from another company. To copy, right-click on the **Assembly** in the **Associated Data Viewer**, and select **Copy**. Then

right-click on the Case you want to paste the Assembly to, and select **Paste** from the drop-down menu.

Activate the Fluid

73a. Select **Case > Fluid Editor** to open the Fluid Editor or double-click on the **Fluid** item in the **Associated Data Viewer**. Specify Fluid data as necessary. Click the **Activate** button to make this the fluid used in the analysis.

Perform Torque Drag Normal Analysis

74a. Activate Normal Analysis mode in the Torque Drag Analysis module as follows:

- Click the Torque Drag toolbar button and then select **Normal Analysis** from the mode drop-down list
- Select **Modules > Torque Drag > Normal Analysis**

75a. Select **Case > Torque Drag Setup** and then specify the Torque Drag analysis options.

76a. Select **Parameter > Mode Data** and then specify the Torque Drag analysis parameters. Click **Advanced** to input friction factors.

77a. Use the Advanced Options dialog to specify friction factors for each operating mode selected using the **Mode Data - Normal Analysis** dialog.

78a. Select **View > Table > Summary Loads** and review a summary of the Normal Analysis results.

Perform Hydraulics Analysis

79a. Activate Pressure: Pump Rate Range mode in the Hydraulics module as follows:

- Click the Hydraulics toolbar button and then select **Pressure: Pump Rate Range** from the mode drop-down list
- Select **Modules > Hydraulics > Pressure: Pump Rate Range**

80a. Select **Case** > **Circulating System** and then specify the circulating system.

a) Select **Case** > **Circulating System** > **Surface Equipment** tab and then specify the surface equipment.

b) Select **Case** > **Circulating System** > **Mud Pumps** tab and then specify the pumps.

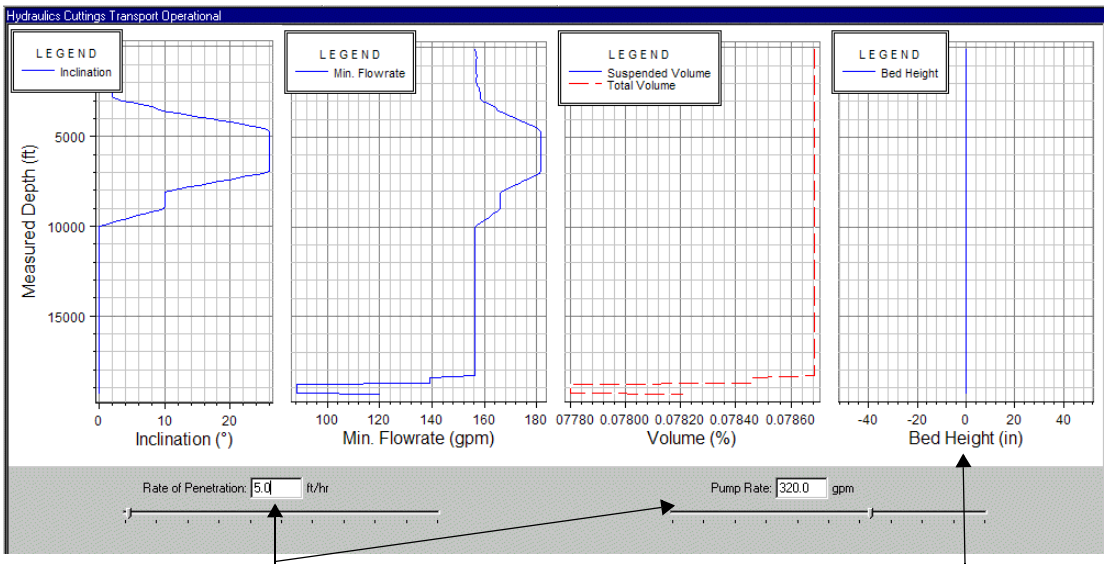
81a. Select **Parameter** > **Rates** and then specify the analysis parameters.

82a. Select **View** > **Plot** > **Pressure Loss** and then review the pressure loss for the range of pump rates.

83a. Analyze hole cleaning using the **Hole Cleaning - Operational** mode. (Select this mode from the **Mode** drop-down list.)

84a. Select **Parameter** > **Transport Analysis Data** and then specify the hole cleaning analysis parameters.

85a. Select **View** > **Plot** > **Operational** then determine if a cuttings bed is likely to form.



Change the ROP and/or pump rate using the sliders or by typing in the associated box. Notice that as the pump rate declines, a cuttings bed forms.

A cuttings bed at the specified ROP and pump rate is not likely to form.

Perform Surge Analysis

86a. Activate the Surge module as follows:

- Click the Surge toolbar button
- Select **Modules** > **Surge**

87a. Select **Case** > **Pore Pressure** and review pore pressure data to ensure that the data entered using CasingSeat software is available to the WELLPLAN application.

88a. Select **Case** > **Fracture Gradient** and review fracture gradient data to ensure that the data entered using CasingSeat software is available to the WELLPLAN application.

89a. Select **Case** > **Formation Properties** and then specify formation properties.

90a. Select **Case** > **Cement Properties** and then specify cement properties.

91a. Select **Case** > **Eccentricity** and then specify the workstring is centered in the annulus, even in the deviated sections.

92a. Select **Parameter** > **Job Data** ensure the desired mud is used in the analysis by reviewing.

93a. Select **Parameter** > **Operations Data** and define a surge operation.

94a. Select **View** > **Operation Plot** > **Transient Response Plot** and review the transient results.

WELLCAT™ User Workflow

Note: This workflow begins after Step 65 (**page 22)** in the StressCheck software workflow. The WELLPLAN software workflow steps (Steps 66a through 94a on pages 23 - 28) are not performed.

66b. Launch WELLCAT software (**Start > Programs > Landmark Engineer's Desktop 5000.0.0 > WELLCAT**). Login if needed.

67b. Select the recently created StressCheck design, and make a copy of it to the associated wellbore.

68b. Rename the design.(The design will have a default name when you copy it.)

69b. Open the design.

70b. The **Open Template** dialog is displayed. Select the template you want to use, and click **OK**.

Using the Drill Module

71b. The design will open. Access the **Prod** module.

72b. Access **Wellbore > Casing and Tubing Configuration**. The string used in the StressCheck portion of this workflow will be displayed, but you can make any changes you want to the string. Because this is a new

73b. Access the **Drill** module by clicking the  **Drill** toolbar button, or by accessing **Tools > Select Product > Drill.**

74b. Define the fluids using **Inventories > Fluids**. Notice there is a separate tab to define each fluid type. Define all required fluids. Refer to the online help for additional information.

75b. Use **Operations > Drilling Operations** to define the operations you want to analyze.

a) Enter the name of the operation in the **Operation Name** field.

b) Select the operation type from the **Operation Type** drop-down list.

c) Select the operation that preceded the operation you are defining from the **Prior Drill Operation** drop-down list.

d) Select the next casing string from the **Next Casing String** drop-down list.

e) Click the **Details** button to define additional information about the operation you are defining. Several tabs will be displayed. Many of the fields on these tabs will have default values provided, but you can change the data as required. The tabs available when you click the **Details** button vary depending on the drill operation selected. Refer to the online help for more detailed information.

76b. Repeat the previous step to define all drill operations required.

77b. Use **Results > Calculate** to calculate the results. The **Calculate** dialog will be displayed. Highlight the operations you want to calculate. Use **CTRL** and **Shift** keys to select multiple operations.

78b. Select **Wellbore > Casing and Tubing Configuration**.

79b. Click the **Save** button to save the data.

80b. Review results using the options available in the **Results** menu.

Using the Prod Module

81b. Access the **Prod** module.

82b. Define any additional fluids using **Inventories > Fluids**. Notice there is a separate tab to define each fluid type. Define all required fluids. Refer to the online help for additional information.

83b. Use **Operations > Operations** to define the operations you want to analyze.

a) Enter the name of the operation in the **Name** field.

b) Select the workstring configuration from the **Configuration** drop-down list.

c) Use the **Type** drop-down list to select the operation type for the **Flow Path**. In many cases, the **Type** selected for one flow path will automatically select the **Type** for the remaining flow path.

d) Select the **Fluid** associated with each **Flow Path** and operation **Type**.

e) Use the drop-down list to specify whether the condition is transient or steady-state. The condition selected determines the calculation used for temperature.

f) Use the **Prior Operation** drop-down list to select the operation preceding the operation you are currently defining.

g) Click the **Details** button to define additional information about the operation you are defining. Several tabs will be displayed. Many of the fields on these tabs will have default values provided, but you can change the data as required. The tabs available when you click the **Details** button vary depending on the production operation selected. Refer to the online help for more detailed information.

84b. Repeat the previous step to define all required operations.

85b. Use **Results > Calculate** to calculate the results. The **Calculate** dialog will be displayed. Highlight the operations you want to calculate. Use **CTRL** and **Shift** keys to select multiple operations.

86b. Select **Wellbore > Casing and Tubing Configuration**.

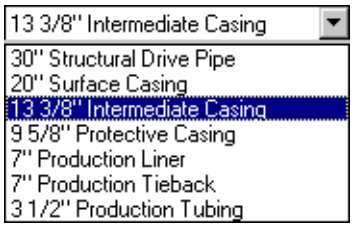
87b. Click the **Save** button to save the data.

88b. Review results using the options available in the **Results** menu.

Using the Casing Module

89b. Access the **Casing** module.

90b. Use the **Current String** drop-down list to select the casing you want to analyze.



91b. Use **Wellbore > Cementing and Landing** to specify the cementing and landing conditions such as cement and displacement fluids, whether the float failed, and pickup and slackoff forces. These data are used to determine the initial state of the casing, and dictate design and analysis logic.

92b. Use **Loads** > **Design Parameters** > **Design Factors** to input or review the design factors that will be used in the analysis. These are the same design factors used in the StressCheck software.

93b. Use **Loads** > **Design Parameters** > **Analysis Options** to input or review the various analysis options that will be used.

94b. Use **Loads** > **Initial Conditions** to specify the initial conditions for the load by defining casing/tubing and annulus profiles. This dialog contains tabs to define the initial conditions for both the string and the annulus. Click the **Fill** button on each tab to use the values from an operation defined using **Drill**.

95b. . Use **Loads** > **Loads** to define the loads you want to analyze.

a) Enter the name of the load in the **Name** field.

b) Use the **Type** drop-down list to select the load type.

c) Use the **External Pressure Profile** drop-down list to select the external pressure profile you want to use.

d) Click the **Details** button to define additional information about the load you are defining. Several tabs will be displayed. Refer to the online help for more detailed information.

96b. Repeat the previous step to define all required loads.

97b. Use **Results** > **Calculate** to calculate the results. The **Calculate** dialog will be displayed. Highlight the loads you want to calculate. Use **CTRL** and **Shift** keys to select multiple loads.

98b. Review results using the options available in the **Results** menu.

99b. Select **Wellbore** > **Casing and Tubing Configuration**.

100b. Click the **Save** button to save the data.

Using the Tube Module

101b. Access the **Tube** module using **Tools** > **Select Product** > **Tube**.

102b. Use **Wellbore** > **Packers** to input or review packer information.

103b. Use **Loads > Design Parameters > Design Factors** to input or review the design factors that will be used in the analysis. These are the same design factors used in the StressCheck software.

104b. Use **Loads > Design Parameters > Analysis Options** to input or review the various analysis options that will be used.

105b. Use **Loads > Initial Conditions** to specify the initial conditions for the load by defining casing/tubing and annulus profiles. This dialog contains tabs to define the initial conditions for both the string and the annulus. Click the **Fill** button on each tab to use the values from an operation defined using **Prod**, or click the **Default** button to use default values provided by the software.

106b. Use **Loads > Loads** to define the loads you want to analyze.

a) Enter the name of the load in the **Name** field.

b) Use the **Type** drop-down list to select the load type.

c) Click the **Details** button to provide additional information about the load.

107b. Repeat the previous steps to all required loads.

108b. Use **Results > Calculate** to calculate the results. The **Calculate** dialog will be displayed. Highlight the loads you want to calculate. Use **CTRL** and **Shift** keys to select multiple loads. If the current string is not a tubing string, a message will be displayed, and the software will use the first tubing. Use the **Current String** drop-down list to select another tubing string if necessary.

109b. Review results using the options available in the **Results** menu.

110b. Select **Wellbore > Casing and Tubing Configuration**.

111b. Click the **Save** button to save the data.

Using the MultiString Module

112b. Use **Tools > Select Product > MultiString**.

113b. Use **Analysis > Annular Fluid Expansion > Define Details** dialog to define the details used for the analysis.

114b. Use **Analysis > Wellhead Movement > Installation and Static Load Definition** to define static loads for each string to be used during the analysis. The loads defined here will be made available in the **Load History Definition** dialog, along with defined load cases for each casing and tubing string, defining the well's wellhead loading history.

115b. Use **Analysis > Wellhead Movement > Load History Definition** to specify static and thermal loads to be applied to the wellhead and the sequence that they are applied.

116b. Calculate the results using **Results > Calculate**. The **Calculate Multax** dialog will be displayed. Use this dialog to calculate and build custom load cases for each sting (casing and tubing) from the MultiString data that were defined through the Analysis menu options. The calculated results can be viewed using the Results menu view options.

117b. After the Multax executable has completed its calculations, another **Calculate** dialog is displayed that lists all **Casing** and **Tube** load cases that were defined, as well as all custom loads. The previously defined **Casing** and **Tube** load cases are recalculated using the displacement results from the **MultiString Wellhead Movement** submenu options (**Analysis > Wellhead Movement**). At the same time, custom load cases that were defined through the **Annular Fluid Expansion** submenu options (**Analysis > Annular Fluid Expansion**) are also calculated. If you do not want to perform these calculations, you can click the **Cancel** button.

118b. After the calculation process completes, the MultiString results are available for viewing using the **Results** menu

119b. Select **Wellbore > Casing and Tubing Configuration**.

120b. Click the **Save** button to save the data.

121b. The **WELLCAT** software can be used for additional analysis, or it can be closed at this time.