



TEST UTILITY USER

BrDR Regression Test Utility (RTU)

GETTING STARTED

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AMERICAN ASSOCIATION OF
STATE HIGHWAY AND
TRANSPORTATION OFFICIALS

AASHTO
THE VOICE OF TRANSPORTATION

1. Tool Overview

1.1 Introduction

Wikipedia defines regression testing as the following:

“Regression testing is a type of software testing that seeks to uncover new software bugs, or regressions, in existing functional and non-functional areas of a system after changes such as enhancements, patches or configuration changes, have been made to them.”

The BrDR Regression Test Utility allows users to perform regression testing between different versions of BrDR.

Differences between two versions of BrDR can occur for several reasons including the following:

- The software was changed intentionally to address a change in the AASHTO specification – an expected and acceptable change.
- The software was changed intentionally to address a coding defect – an expected and acceptable change.
- The software was changed intentionally to provide a user requested enhancement – an expected and acceptable change
- The software was inappropriately changed thus introducing a defect – an unexpected and unacceptable change.

Differences between two analytical engines can occur for several reasons including the following:

- Differences can occur when the two engines produce different results because of differing assumptions.
- One engine is more rigorous or refined than the other.
- Differing interpretations of the AASHTO specifications.
- One or both engines have a defect.

When a difference is found as a result of regression testing, the user must investigate to determine the cause. This regression tool can help a user compare two analyses, identify the cause of the differences, and using the comparisons and a working knowledge of the change/enhancement, determine if the differences are expected and acceptable.

1.2 Features – What does the Regression Test Utility do?

The Regression Test Utility allows the user to compare the following results between two different versions of BrDR:

- Text comparison for the specification check articles. This comparison requires the use of a third party text comparison software such as Beyond Compare or WinMerge.
- Graphical comparisons of dead load and live load actions, including moment, shear, deflection, etc.
- Graphical comparison of computed specification check data

The AASHTO analytical engines in BrDR store regression data associated with report ID's similar to the NCHRP 12-50 process (See *NCHRP Report 485 – Bridge Software – Validation Guidelines and Examples*). If a third-party analytical engine stores regression data with the same report ID's in an RTU file similar to that produced by BrDR, then the regression tool can also be used to compare results between the 2 analytical engines.

2. Tool interface and testing procedure

The regression tool has two interfaces (TestUtilityUser and TestUtility, see Figure 1 and Figure 2). TestUtilityUser is a simpler version of TestUtility that allows the comparison of any two RTU (Regression Testing Utility) and SCA (Specification Check Articles) files. This document will focus only on the usage of TestUtilityUser. A separate, comprehensive tutorial on the main TestUtility user interface is provided in a separate document.

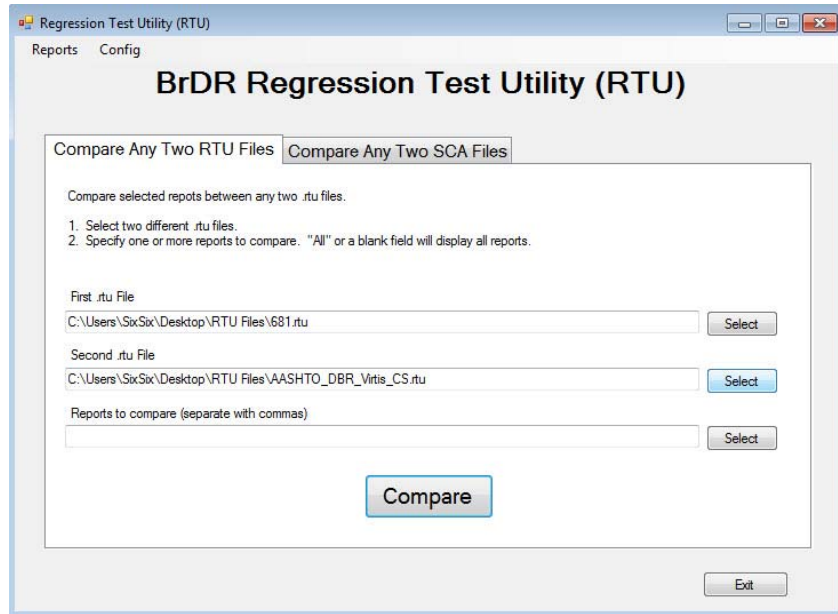


Figure 1. TestUtilityUser

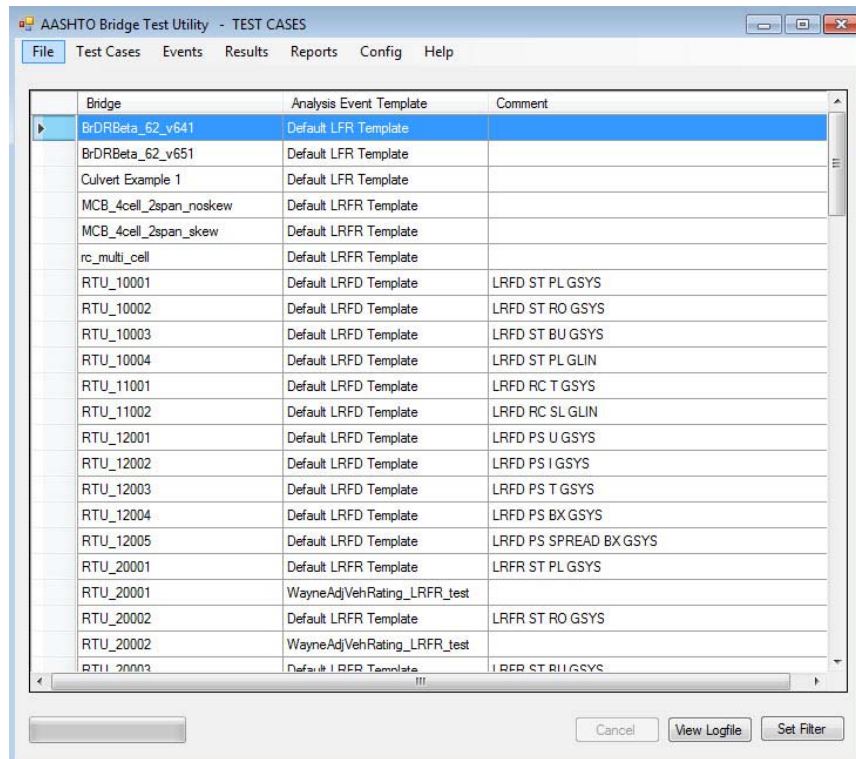


Figure 2. Main user interface - TestUtility

2.1 Unzipping Utility Package

The utility is packaged in a zipped folder. To unzip this folder, you may use WinZip (or any zip software). The easiest way to unzip is simply clicking on the 1-Click Unzip option in Figure 3. This will unzip the folder in the same directory as the zipped file. If users do not have WinZip, an alternative method is just open the compressed folder and extract the folder to a different directory (see Figure 4).

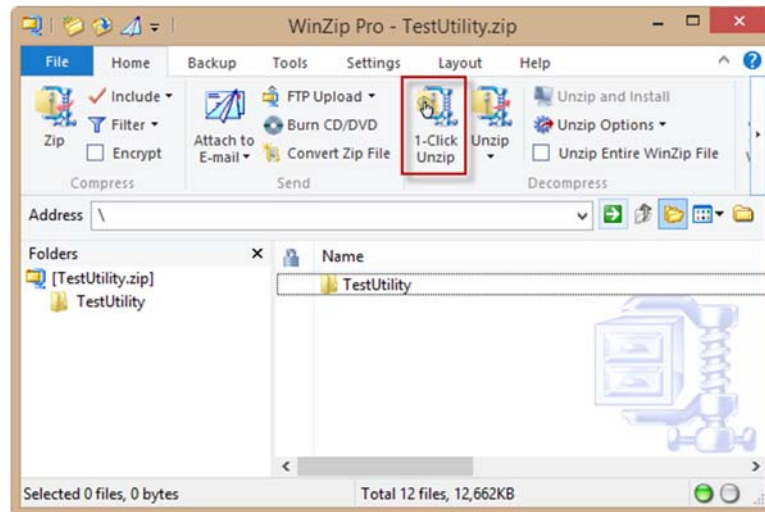


Figure 3. WinZip Pro

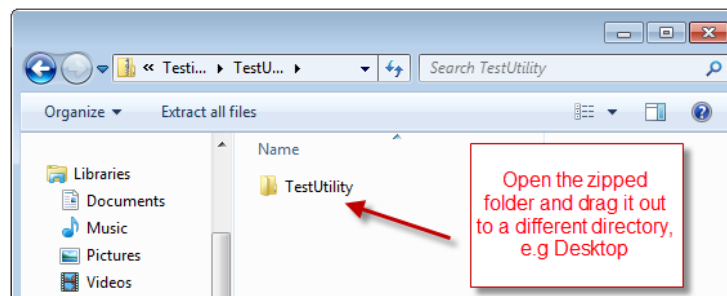


Figure 4. Unzipping without WinZip

2.2 Configuring Database

The regression test utility uses a database to store information. A sample database (AashtoBridgeTestUtility.mdf) is included with the utility and must be configured before using the utility. In order to configure/attach the database, it is necessary to have SQL Server Management Studio installed on the user's computer. If the user does not have the management studio installed on their computer, they may download it from

(<https://msdn.microsoft.com/en-us/library/mt238290.aspx>).

Users will not be able to open the utility if a database with the name (AashtoBridgeTestUtility) is not created or attached.

To attach the database, run Microsoft SQL Server Management Studio as administrator (see Figure 5). When the studio is opened, right click on Database and select Attach (see Figure 6).

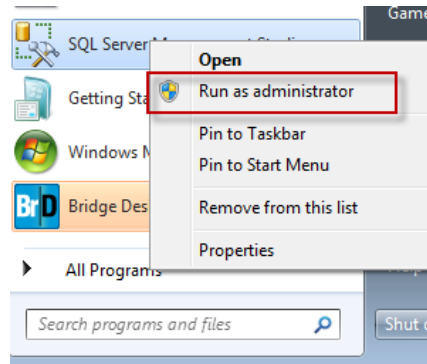


Figure 5. Run Management Studio as administrator

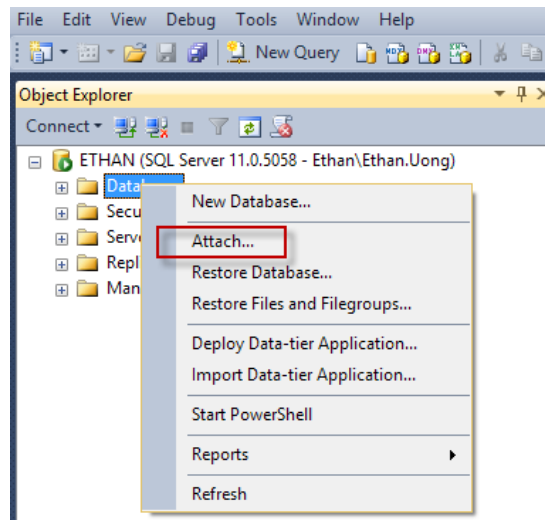


Figure 6. Attaching database in SQL Server Management Studio

Browse to the location of the MDF file and select the database by clicking on the 'Add' button and browsing to the database file as shown in Figure 7. If users have BrDR installed on their computer, a convenient location would be

C:\ProgramData\AASHTOWare\BrDR68\Database\SQL Server 2012

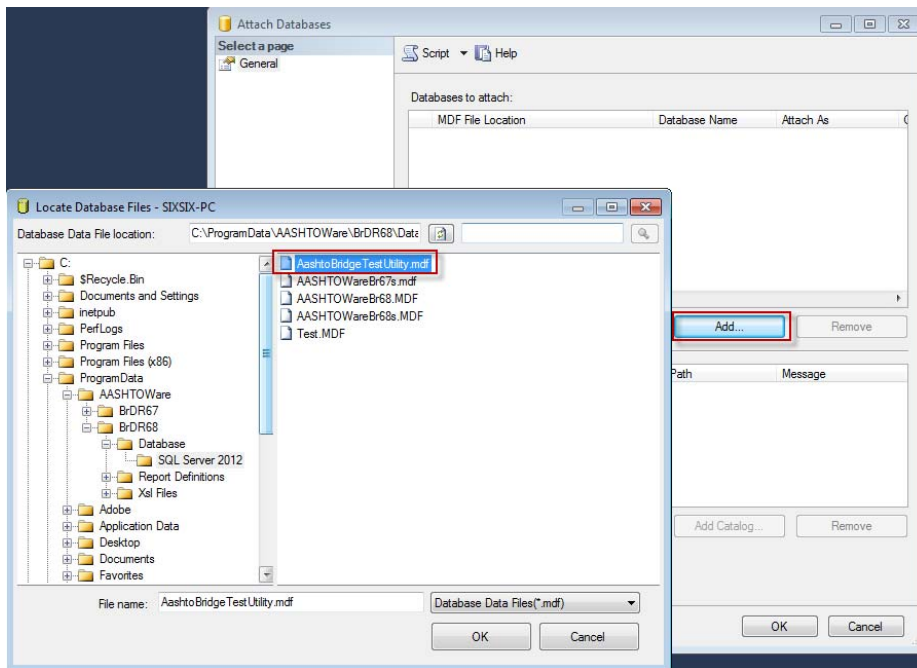


Figure 7. Locating TestUtility database

2.3 Opening TestUtilityUser

Go to the folder that the utility was placed from the zip file (see Section 2.1). Open the TestUtilityUser application as shown in Figure 8.

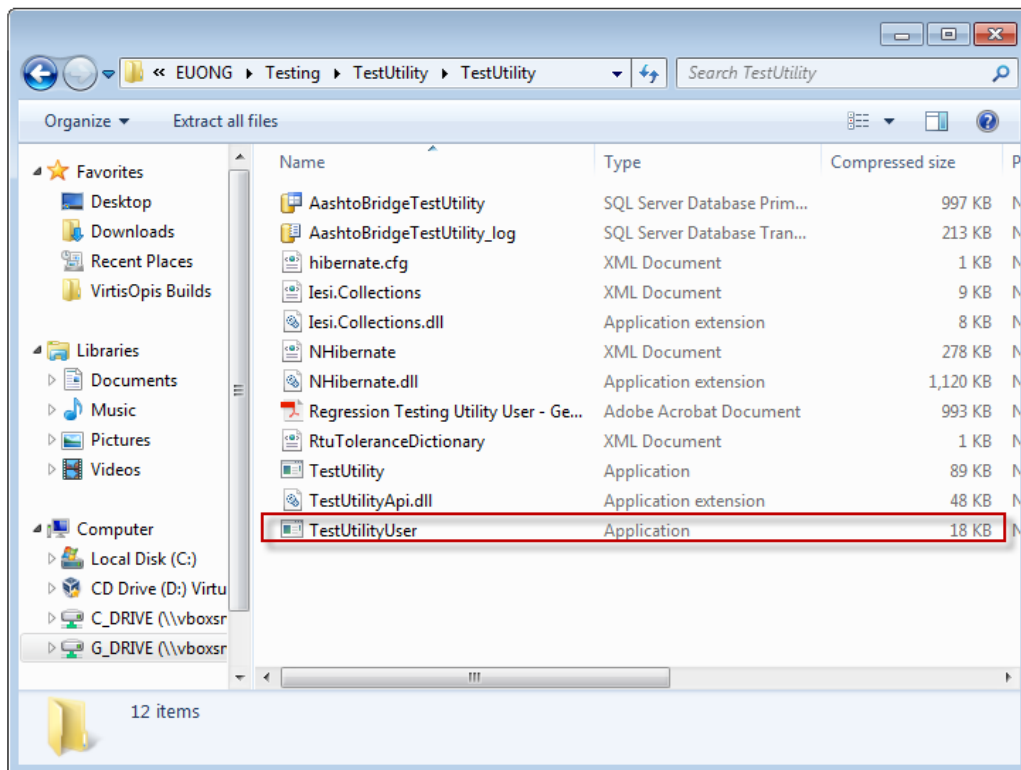


Figure 8. Open TestUtilityUser

2.4 Reports and Configuration windows

To get started, it is important to manage the reports and configure the utility.

Click on Reports on the menu bar to open the Manage Reports window as shown in Figure 9.

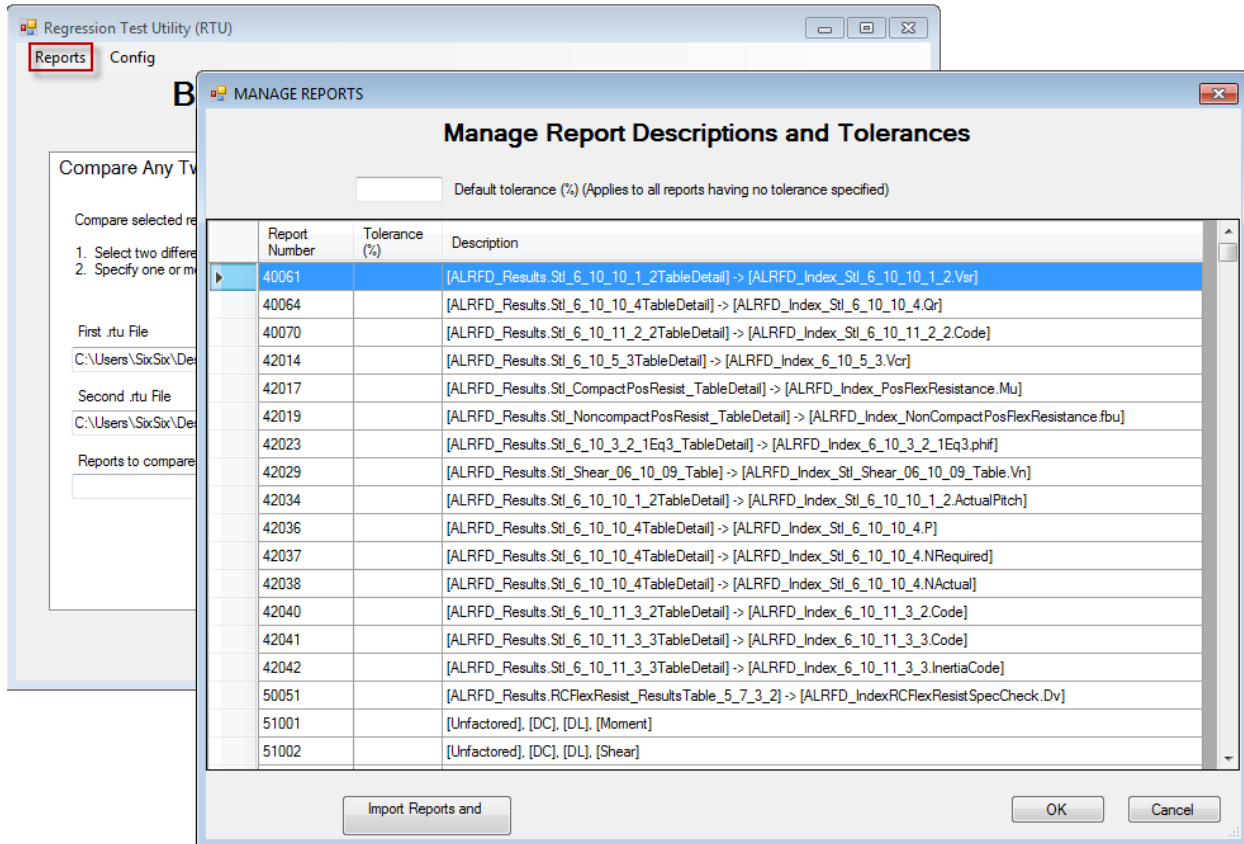


Figure 9. Manage Reports window

This window contains a grid that lists all the available reports, description and tolerances. A “report” is a number assigned to a specific type of value (refer to NCHRP 12-50) produced by a BrDR analysis. For example, NCHRP 12-50 defines report numbers 50042 through 50045 to be shear resistance values Vr, Vn, Vc and Vs. TestUtilityUser graphs these values and calculates differences between two different analyses (see the Graph section below). These reports are prepopulated from the included database (AashtoBridgeTestUtility), users are not able to add or delete report from the user interface.

A report can have a tolerance assigned to it. The tolerance is used to determine whether the result of two analyses are considered OK or not. Generally, regression testing is looking for zero change. However, there are some useful exceptions. For example, when results from two different programs are being compared or when BrDR’s values change slightly due to a bug fix or other planned modification.

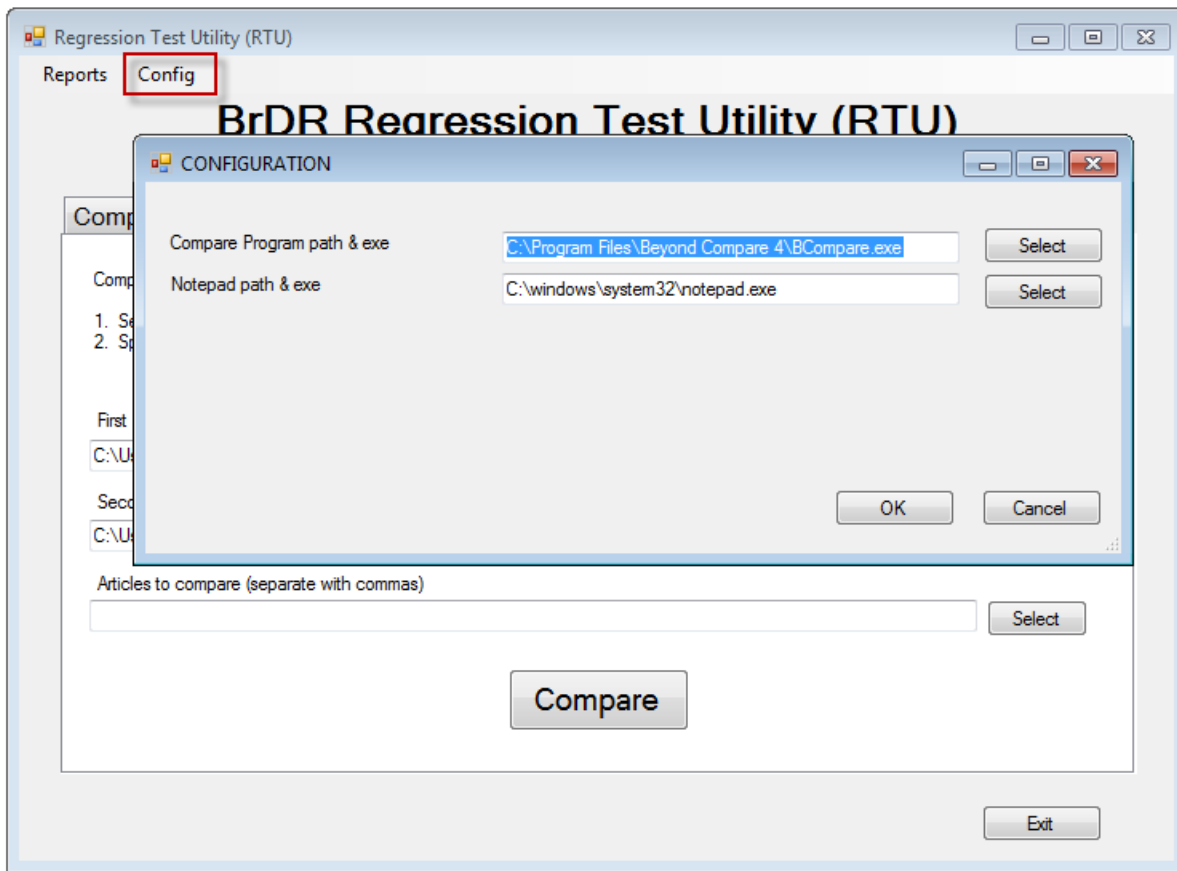


Figure 10. Configuration window

The Configuration window points to helper programs on your computer.

The first path (“Compare Program path & exe”) points to the directory of a comparison software such as Beyond Compare. This is needed to compare two text files (specification check articles) side by side. There are free text comparison software online that users may download. ExamDiff is one of them. Users may also use online tool such as Diff Checker and Text Compare.

The second path (“Notepad path & exe”) points to the directory of a text editor such as Notepad or Wordpad. The default is C:\windows\system32\notepad.exe as Notepad is generally used, however the utility tool may open any text editor including Microsoft Word.

For both windows, click OK to save or Cancel to close the window without saving.

2.5 Producing RTU and SCA files

An RTU (regression testing utility) file contains dead load, live load, and other values calculated during spec checking. Report numbers are assigned to different types of values.

A SCA (specification check article) file contains the text output from each spec article as it appears in BrDR. One RTU and one SCA file is generated for each member alternative.

To use this utility, you will need two RTU or SCA files. This section of the document will show you how to produce RTU and SCA files in BrDR and manually compare them in the regression utility.

Open BID1 (TrainingBridge1) in BrDR and run an analysis on any member alternative with the Regression Data box checked under AASHTO Engine Reports of the Output tab of the Analysis Settings window as seen in Figure 11 below.

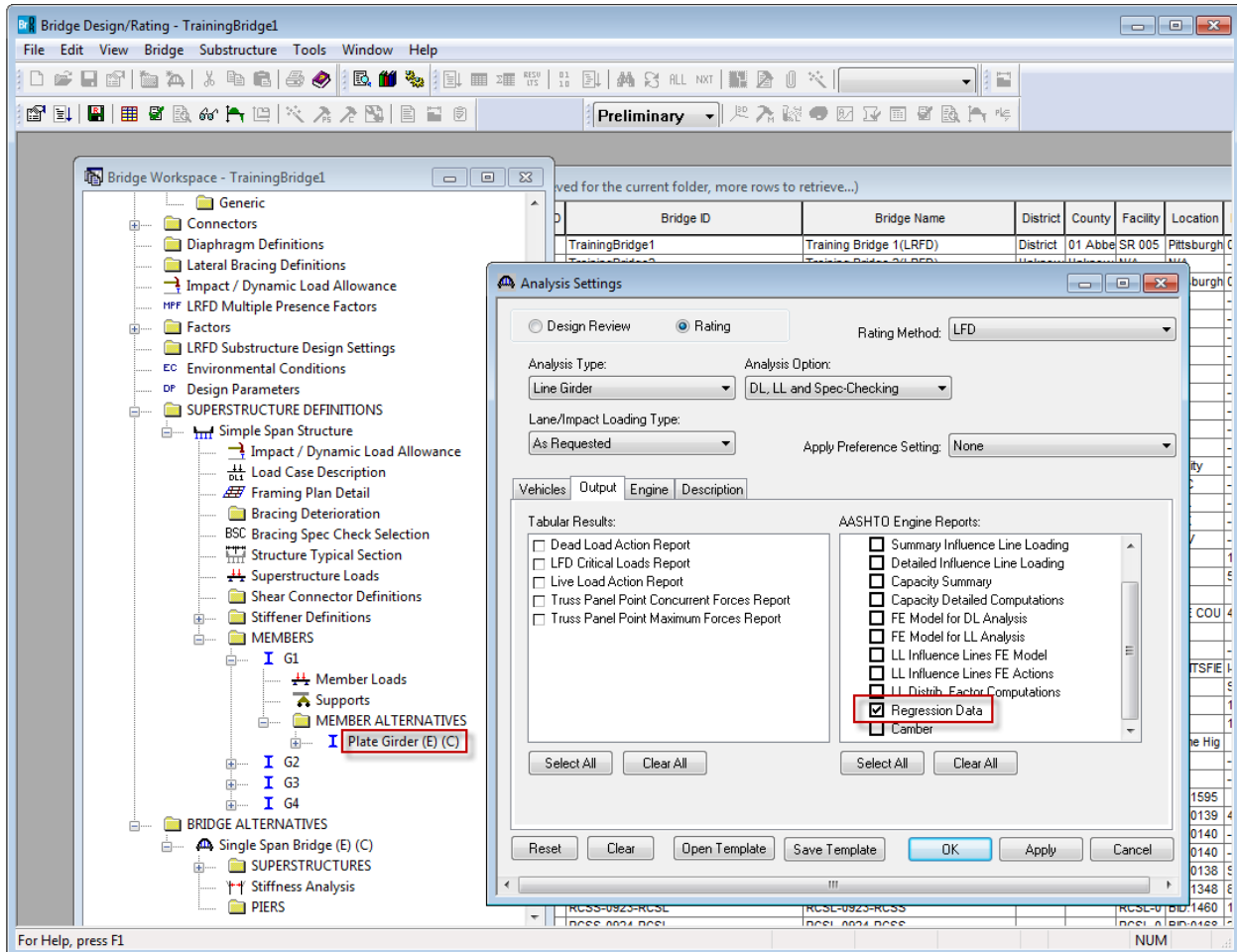
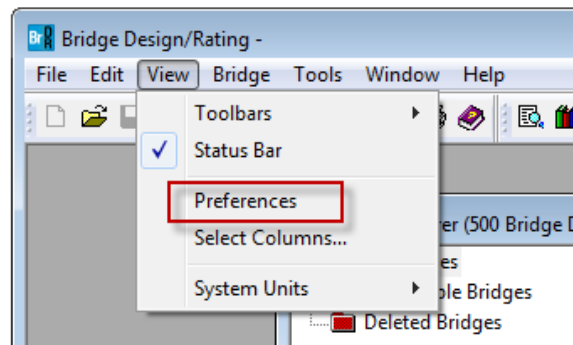


Figure 11. Output tab of the Analysis Settings window

These engine data are stored in the users analysis output folder. To recall the path of this folder, go to View-Preferences and then to the Analysis tab. The folder path is listed under “Analysis Output Folder” (see Figure 12).



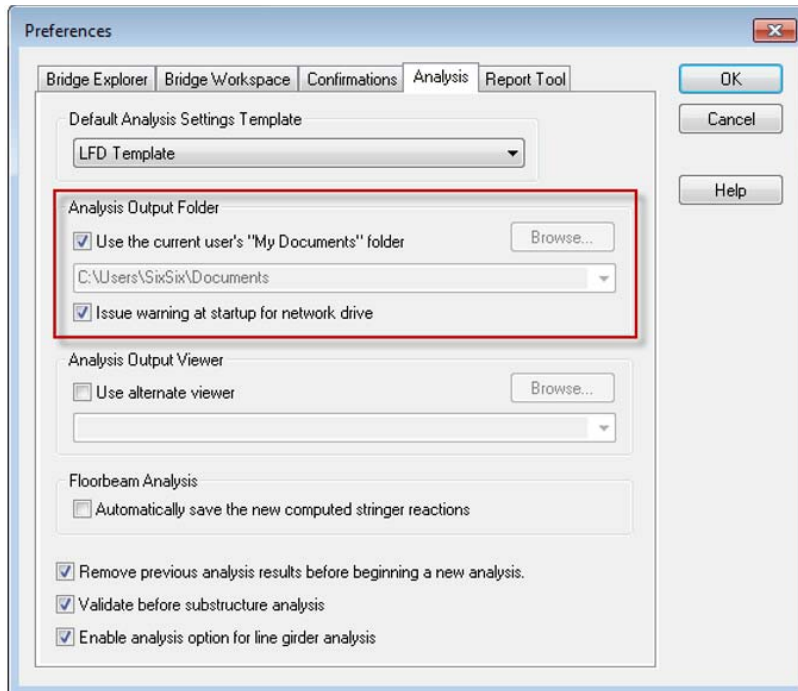
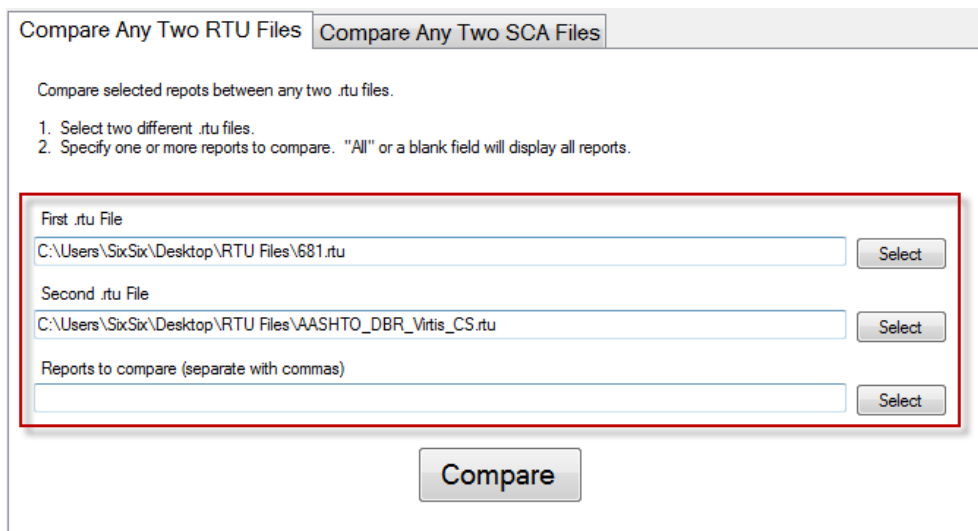


Figure 12. Analysis tab of the Preferences window

This process is repeated for a different scenario such as previous version of the software to produce a second set of RTU and SCA files. Keep in mind that rerunning an analysis will overwrite these files, therefore it is suggested to rename and copy them to a separate directory.

2.6 Comparing RTU and SCA files

In the testing utility, select the two RTU files to compare. You can also limit the set of reports presented in the Report Detail window by selecting the option “Reports to compare.”



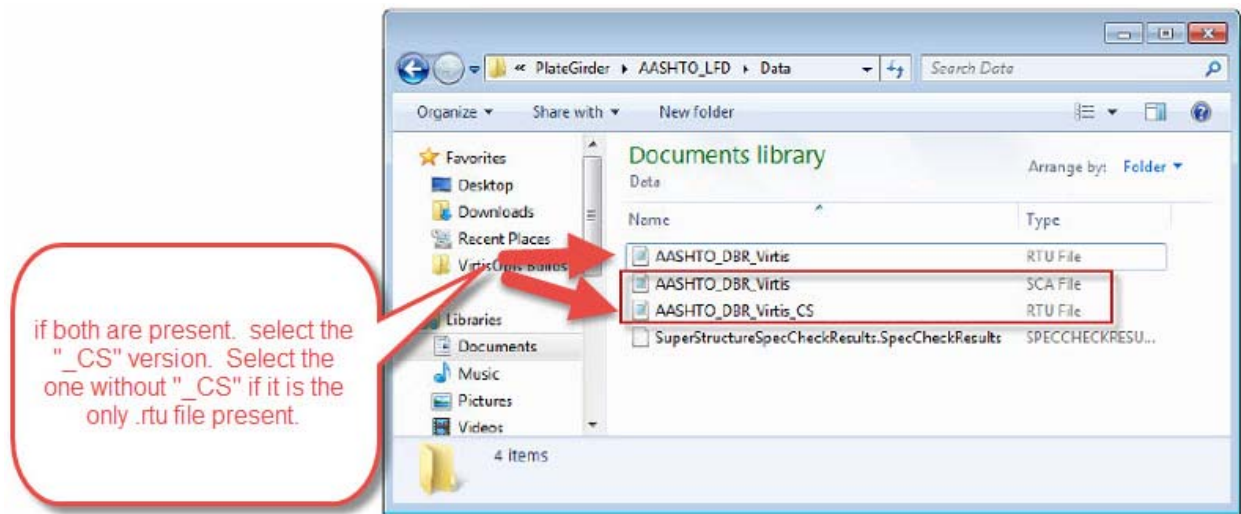


Figure 13. Choosing files to compare

For the RTU comparison, we have results for each report.

Report ID	Report Description	Text Compare Event 1 Dif (%)	Text Compare Event 2 Dif (%)	Area Dif (%)	Ord Dif (%)	Toler. (%)	Result
52008	[Lane], [Unfactored], [Shear Y], [LL]	97.1	97.1	94.2	93.6	0.000	DIF
52002	[Unfactored], [Shear Y], [Axle], [LL]	97.1	97.1	94.3	93.6	0.000	DIF
52001	[Unfactored], [LL], [Axle], [Moment Z]	47.1	47.1	93.3	93.3	0.000	DIF
52007	[Unfactored], [LL], [Lane], [Moment Z]	47.1	47.1	93.3	93.3	0.000	DIF
30520	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
30615	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
30501	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
30613	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
91004	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
91005	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
73113	[ASTD_Results.CriticalResultsTable_Shear_Vehicle] -> [ASTD_IndexRatingLevelTab...	100.0	0.0	100.0	100.0	0.000	DIF
91001	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
73111	[ASTD_Results.CriticalResultsTable_Flexure_Vehicle] -> [ASTD_IndexRatingLevelTa...	100.0	0.0	100.0	100.0	0.000	DIF
73112	[ASTD_Results.CriticalResultsTable_OverloadFlexure_Vehicle] -> [ASTD_IndexRatin...	100.0	0.0	100.0	100.0	0.000	DIF
30523	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
30522	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF
30524	Report Not Found	100.0	0.0	100.0	100.0	0.000	DIF

Figure 14. Regression Tool – Report Detail

Right clicking on report number 52002 and selecting Show Graph displays the values for this report in graphical form.

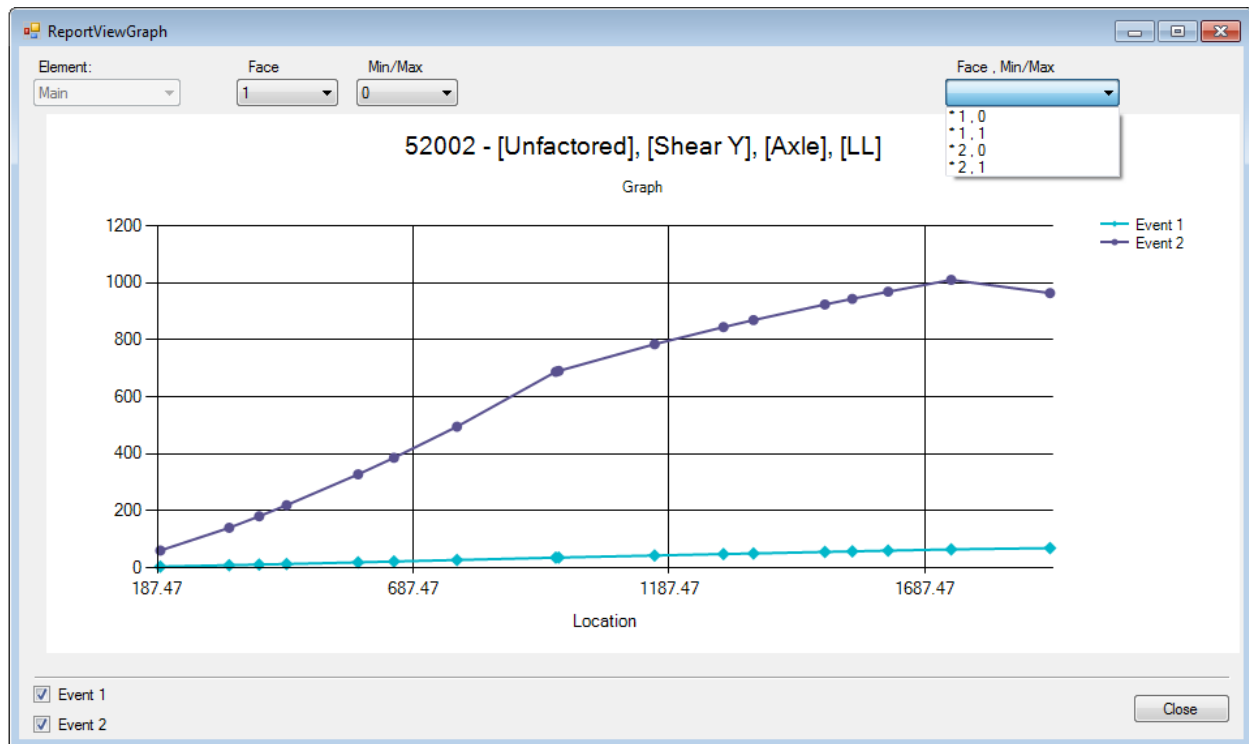


Figure 15. Report graph

Values are displayed along the length of the girder for each variation of (in this case) Face and Vehicle. The ComboBox on the top right of the graph allows you to quickly scroll through each chart. A chart marked with an (*) has differences. The % difference values shown on the parent (Report Detail) window represent the following:

- Percent difference in the areas between the two graphs. Areas are calculated using the trapezoids under each point with vertical lines projected to the axis origin below. The percentage is $(\text{larger area} - \text{smaller area}) * 100 / (\text{larger area})$.
- Percent difference in ordinate values between the two graphs. The percentage is $(\text{difference in ordinate values}) * 100 / (\text{largest ordinate value})$.

The comparison of the SCA files is provided for every article at the different stages and locations. The rightmost column (“Compare”) tells the users if the SCA files are different for that particular location, stage, and article (see Figure 16).

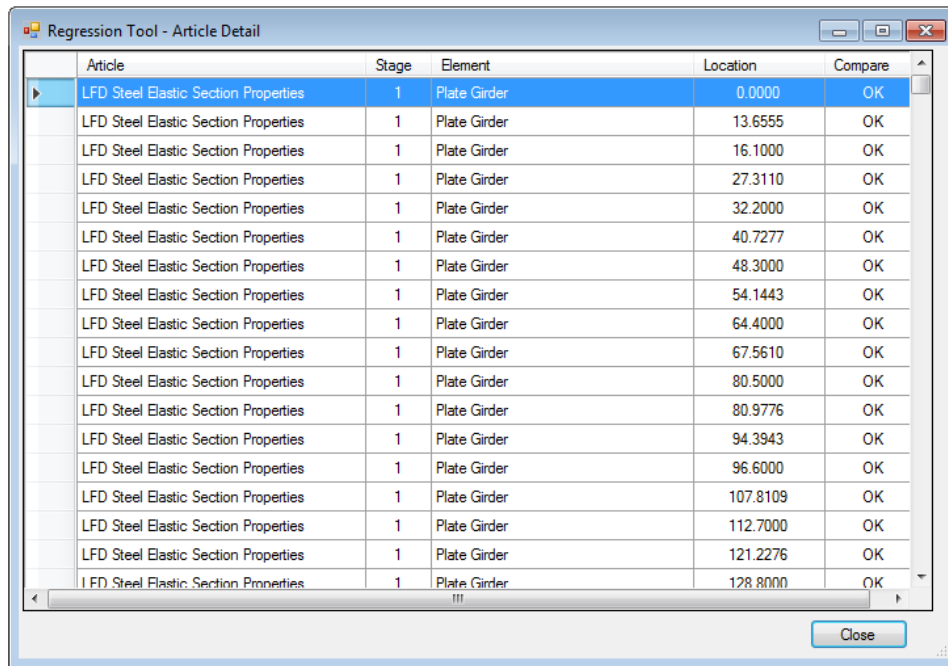


Figure 16. Regression Tool – Article Detail

For articles that contain differences, we may compare the text by right clicking on that article and choosing Text Compare (see Figure 17). This will open a window using the text comparison software that you configured.

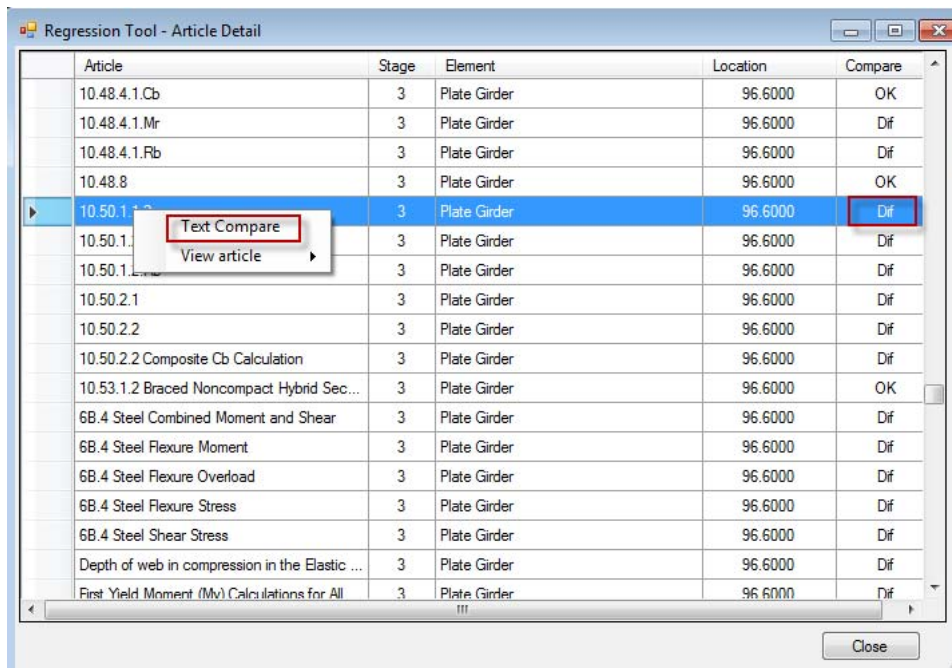


Figure 17. Text compare in the Article Detail window

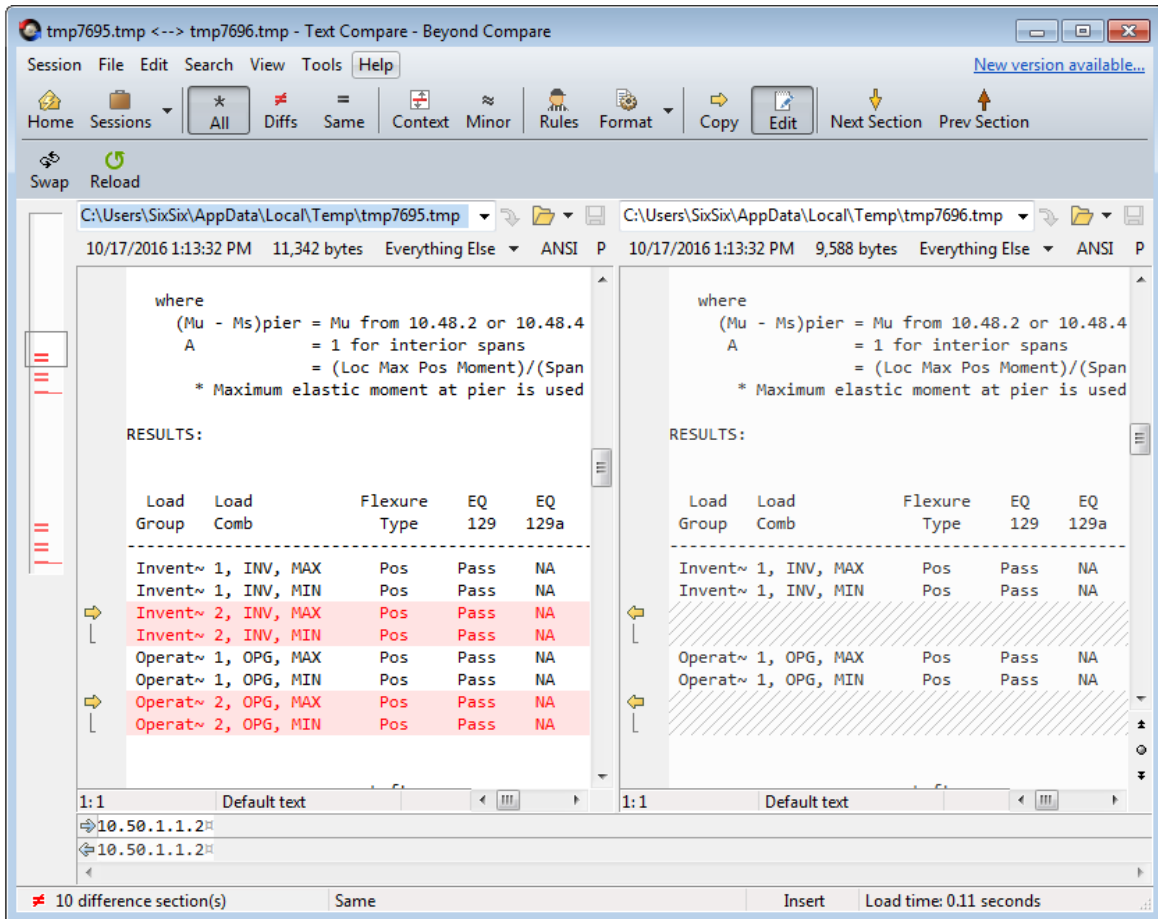


Figure 18. Text comparison software displaying differences in a specification article

The user may also open individual articles in the text editor software that was configured.

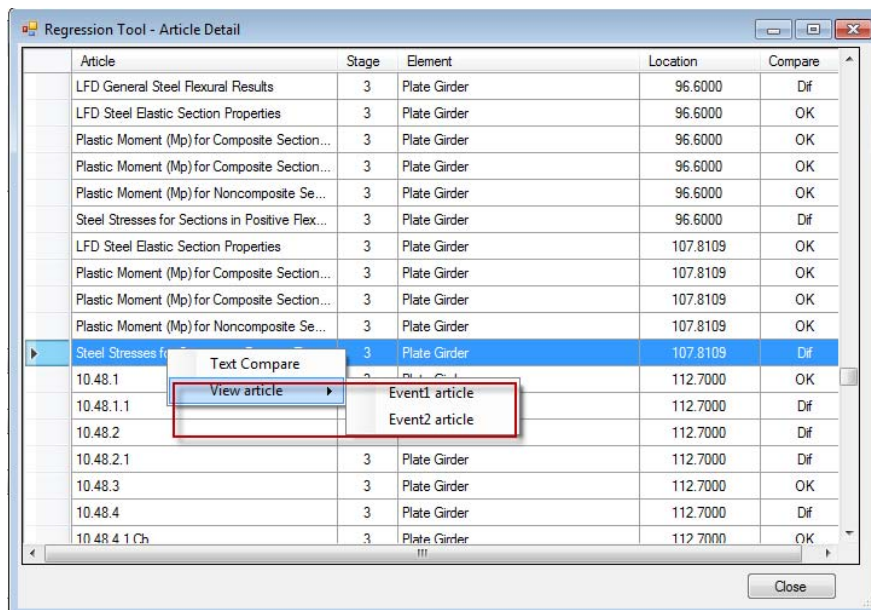


Figure 19. Opening an article in the text editor