

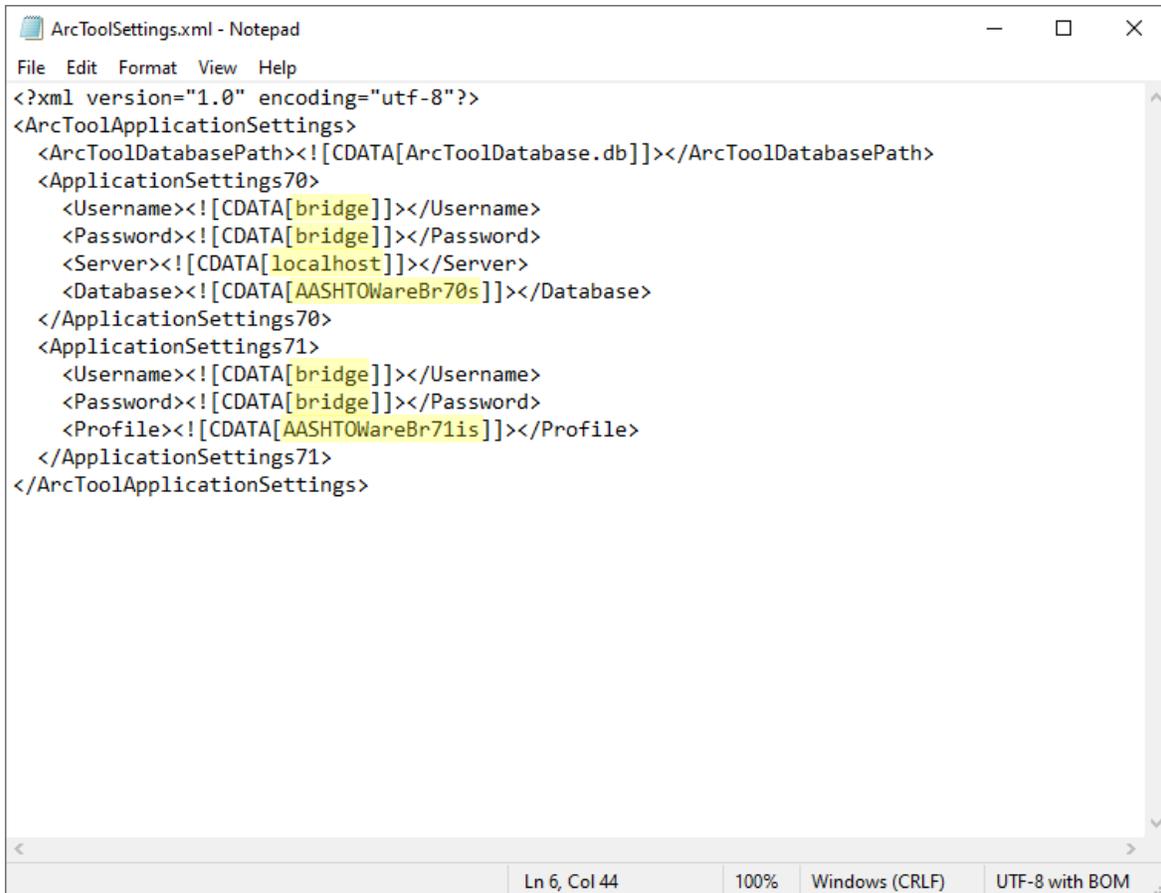
*AASHTOWare BrD/BrR 7.1.0*

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*Analysis Results Comparison (ARC) Tool Tutorial*



## ARC1 – ARC Tool



```
<?xml version="1.0" encoding="utf-8"?>
<ArcToolApplicationSettings>
  <ArcToolDatabasePath><![CDATA[ArcToolDatabase.db]]></ArcToolDatabasePath>
  <ApplicationSettings70>
    <Username><![CDATA[bridge]]></Username>
    <Password><![CDATA[bridge]]></Password>
    <Server><![CDATA[localhost]]></Server>
    <Database><![CDATA[AASHTOWareBr70s]]></Database>
  </ApplicationSettings70>
  <ApplicationSettings71>
    <Username><![CDATA[bridge]]></Username>
    <Password><![CDATA[bridge]]></Password>
    <Profile><![CDATA[AASHTOWareBr71is]]></Profile>
  </ApplicationSettings71>
</ArcToolApplicationSettings>
```

Only the information within CDATA[] should be replaced. For example, to update the username field to JDOE, the line should be updated as follows:

```
<Username><![CDATA[JDOE]]></Username>
```

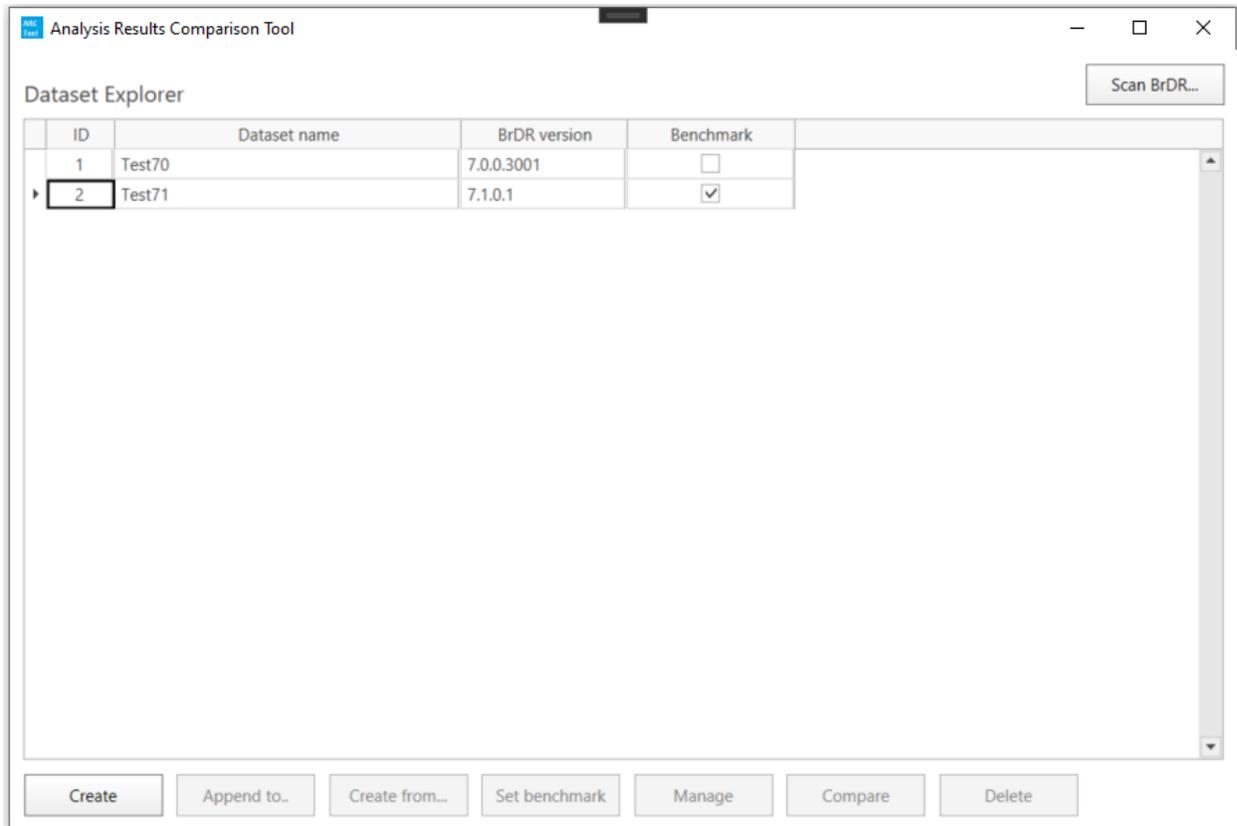
Save the ArcToolSettings.xml file and close it. Now upon opening the ARC Tool, the program will connect to the specified versions of BrDR automatically.

### Export Bridge XML Files

The ARC Tool analyzes bridges directly from XML files rather than connecting to a database like BrDR. Bridge XML files can be generated by exporting bridges from a particular version of BrDR. Please note, version conversion is available in the ARC Tool for forward compatibility but not backward compatibility. For example, bridges exported from BrDR version 7.0 can be used to generate datasets for versions 7.0 and later but bridges exported from BrDR version 7.1 cannot be used to generate datasets for BrDR version 7.0.

### Data Explorer Window

Open the ARC Tool executable file to open the Dataset Explorer window (this is 'ArcToolUi.exe' located in the folder {BrDR installation folder}\ArcTool ). This is the ARC Tool's main window and can be used to access the features in the ARC Tool.



### Scan BrDR

Scans the user's computer for installed versions of BrDR (7.0.0 and later) and imports analysis setting templates.

### Create

Allows the user to generate a new dataset.

### Append to

Allows the user to generate new data and add it to an existing dataset.

### Create From

Allows the user to generate a new dataset from an existing dataset using a different version of BrDR.

### Set benchmark

Sets the selected the dataset as the benchmark.

### Manage

Allows the user to view and delete the items within the selected dataset.

### Compare

Runs a Level 1 comparison on 2 selected datasets or 1 selected dataset against the benchmark dataset.

### Delete

Deletes the selected dataset(s).

### Register Installed Versions of BrDR and Import Analysis Settings Templates

The first step in using the ARC Tool is to register the installed versions of BrDR and import the existing Analysis Settings Templates. Click on Scan BrDR in the Dataset Explorer window to run this process. If any versions of BrDR are installed or uninstalled or if Analysis Settings Templates are created or removed, this step should be repeated.

### Creating and Appending to a Dataset

The ARC Tool can be used to generate rating data for different versions of BrDR and store the data in a local database to be used in comparison analyses. This section describes the different ways to create and update rating datasets.

#### Create a Dataset

The next step in using the ARC Tool is to generate rating data from the different BrDR versions. Click ‘Create’ in the Dataset Explorer window to open the Create Dataset window. Type in a name and description for the dataset. The BrDR version and Analysis Settings dropdown menus will be automatically populated after running ‘Scan BrDR’ in the previous section. Select a BrDR version and Analysis Settings Template from the dropdown menus. Click ‘Browse’ and select the folder where the exported bridge XML files are stored. To generate analysis data at the point of interest level, select the ‘Generate Level 3 Analysis’ checkbox. Click ‘Generate’ to connect to the selected version of BrDR and generate the new dataset.

*Note: ‘Generate Level 3 Analysis’ is not selected by default because it will produce large amounts of data. The database has an upper limit of 4gb. The tool will not function if the database is filled to the maximum amount. It is recommended that for large datasets, users run the tool without generating level 3 data. If a discrepancy is found in the level 1 or level 2 data, a new dataset can be created to generate level 3 data for only the bridges of interest.*

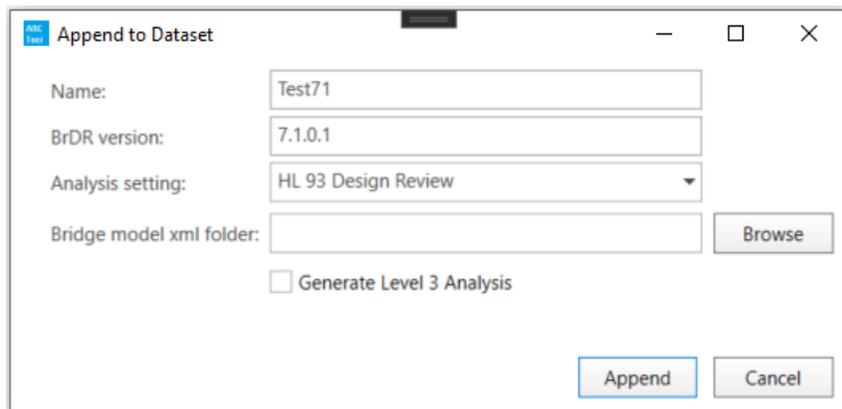
The screenshot shows a 'Create Dataset' dialog box with the following fields and options:

- Name: testBridges70
- Description: A sample dataset of version 7.0.0 bridges
- BrDR version: 7.0.0.3001
- Analysis setting: HS 20 LFD Rating
- Bridge model xml folder: D:\Temp\TestBridges
- Generate Level 3 Analysis:
- Buttons: Generate, Cancel

### Append to a Dataset

New data can also be added to an existing dataset by using the ‘Append to’ option. Select the dataset to be updated and click ‘Append to’ in the Dataset Explorer window to open the Append to Dataset window. The name and BrDR version will be read-only and are automatically populated with the information from the existing dataset. Select an analysis setting template from the dropdown menu. Click ‘Browse’ and select the folder where the exported bridge XML files are stored. To generate analysis data at the point of interest level, select the ‘Generate Level 3 Analysis’ checkbox. Click ‘Append’ to generate new data for the selected bridge models and append it to the specified dataset.

*Note: ‘Generate Level 3 Analysis’ is not selected by default because it will produce large amounts of data. The database has an upper limit of 4gb. The tool will not function if the database is filled to the maximum amount. It is recommended that for large datasets, users run the tool without generating level 3 data. If a discrepancy is found in the level 1 or level 2 data, a new dataset can be created to generate level 3 data for only the bridges of interest.*



### Create Dataset From

A new dataset can also be created for another version of BrDR using the same inputs as an existing dataset. Select a dataset in the Dataset Explorer window and click ‘Create From’ to open the Create Dataset From window. Enter the name and description of the new dataset and select the version of BrDR to use. To generate analysis data at the Point of Interest level, select the ‘Generate Level 3 Analysis’ checkbox. Click ‘Generate’ to create the new dataset.

*Note: ‘Generate Level 3 Analysis’ is not selected by default because it will produce large amounts of data. The database has an upper limit of 4gb. The tool will not function if the database is filled to the maximum amount. It is recommended that for large datasets, users run the tool without generating level 3 data. If a discrepancy is found in the level 1 or level 2 data, a new dataset can be created to generate level 3 data for only the bridges of interest.*

The screenshot shows a 'Create Dataset From' dialog box with the following fields and values:

- Name: [Empty]
- Description: [Empty]
- From dataset name: Test71
- BrDR version: 7.0.0.3001
- Analysis setting: HS 20 LFD Rating
- Bridge IDs: TrainingBridge1, TrainingBridge2, TrainingBridge3
- Bridge model XML folder(s): D:\Temp\TestBridges
- Generate level 3 analysis

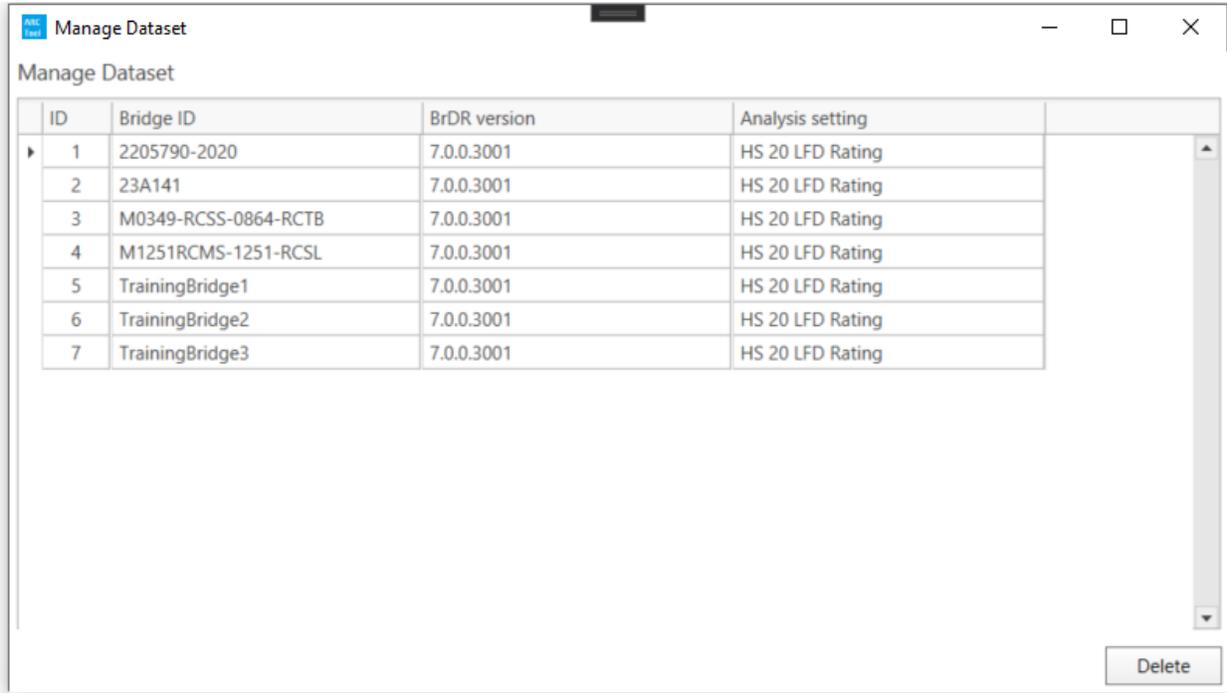
Buttons: Generate, Cancel

### Set Benchmark

To set or change the existing Benchmark dataset, select a row and click ‘Set Benchmark’. The Benchmark will be the default comparison dataset when only one dataset is selected in the Dataset Explorer.

### Manage Datasets

To view the bridge data within a dataset, select a row and click ‘Manage’. This will open the Manage Dataset window which displays a list of all the data items within a dataset by Bridge ID, BrDR version, and Analysis setting. Items can be deleted from a dataset by selecting rows and clicking ‘Delete’.



### Delete

The user can delete entire datasets from the ARC Tool by selecting rows in the Dataset Explorer window and clicking ‘Delete’.

## Operation of the ARC Tool Comparison Feature

Once at least 2 rating datasets have been generated in the ARC tool, the user can run dataset comparison analyses. The following section describes how to generate comparison data in the ARC tool.

### Compare Datasets

To compare two datasets, select the two rows in the Dataset Explorer window or to compare one dataset against the benchmark, select one row in the Dataset Explorer window. Click compare to open the Dataset Comparison Setting window. The Dataset Comparison Setting window will display the name, BrDR version, analysis settings template, and Bridge IDs for the datasets to be compared. The display tolerances and exclude comparison ratios can also be updated in this window. Please note, only the RF or DR tolerance is used for level 1 and level 2 comparisons. The capacity, dead load, and live load percent changes are only shown for level 3 comparisons.

The screenshot shows the 'Dataset Comparison Setting' dialog box. It is divided into two columns for 'Dataset 1' and 'Dataset 2'.  
**Dataset 1:**  
 Name: Test71  
 BrDR version: 7.1.0.1  
 Analysis settings: HS 20 LFD Rating  
 Bridge IDs: TrainingBridge1, TrainingBridge2, TrainingBridge3, M0349-RCSS-0864-RCTB, M1251RCMS-1251-RCSL, 23A141, 2205790-2020  
 Benchmark  
 Capacity tolerance (%): 1.0  
 DL tolerance (%): 1.0  
 LL tolerance (%): 1.0  
 RF or DR tolerance (%): 1.0  
**Dataset 2:**  
 Name: Test70  
 BrDR version: 7.0.0.3001  
 Analysis settings: HS 20 LFD Rating  
 Bridge IDs: TrainingBridge1, TrainingBridge2, TrainingBridge3, M0349-RCSS-0864-RCTB, M1251RCMS-1251-RCSL, 23A141, 2205790-2020  
 Benchmark  
 Exclude comparison for ratio of:  
 Capacity/DL >: 99.0  
 RF >: 99.0  
 Buttons: Run level 1 compare, Cancel

### Level 1 Comparison

Click ‘Run level 1 compare’ in the Dataset Comparison Setting window to run a level 1 comparison on the selected datasets. This will open the Level 1 Comparison window which displays the results of the comparison by the controlling rating factor for each bridge. If the location or limit state is different between the two datasets, the value for that column will be shown in red. If the rating/design factor percent change between the two datasets is greater than the RF or DR tolerance specified in the Dataset Comparison Setting window, the value for that column will be shown in red.

To view the settings for this comparison, click ‘View comparison setting’ in the top right corner of the window. This will open the Dataset Comparison Setting window in read-only mode.

To export the results to a CSV file, click ‘Export to CSV’ and select a location to save the file.

The Comparison Summary shown in the bottom left of the window provides a summary of the level 1 results. If either dataset 1 or dataset 2 does not have a rating/design factor, the comparison will be counted as a failure. If the limit state or controlling location are different between dataset 1 and dataset 2 or the rating/design factor percent change is not within the specified tolerance, the comparison will be counted as unacceptable. If the limit state and location are both the same and the rating/design factor percent change is within the specified tolerance, the comparison will be counted as acceptable.

The ‘Show all within tolerance’, ‘Show all outside tolerance’, ‘Show comparison failure’, and ‘Show all’ buttons at the bottom of the Level 1 Comparison window can be used to filter the data grid by rating/design factor percent change tolerance.

Level 1 Comparison

RF or DR Tolerance(%): 1.0

ID	Bridge ID	Vehicle	Rating or design	Dataset 1 RF or DR	Dataset 2 RF or DR	Percent change (%)	Location same?	Limit state same?	Dataset 1 Run Time...	Dataset 2 Run Time...
4	23A141	HS 20-44	Operating	1.072	0.033	-96.926	No	No	5.375	5.313
5	M0349-RCSS-0864...	HS 20-44	Inventory	0.719	0.719	0.000	Yes	Yes	2.146	1.996
6	M0349-RCSS-0864...	HS 20-44	Operating	1.199	1.199	0.000	Yes	Yes	2.146	1.996
7	M1251RCMS-1251...	HS 20-44	Inventory	1.027	1.027	0.000	Yes	Yes	1.674	1.668
8	M1251RCMS-1251...	HS 20-44	Operating	1.684	1.684	0.000	Yes	Yes	1.674	1.668
9	TrainingBridge1	HS 20-44	Inventory	0.877	0.877	0.000	Yes	Yes	4.858	3.440
10	TrainingBridge1	HS 20-44	Operating	1.464	1.464	0.000	Yes	Yes	4.858	3.440
11	TrainingBridge2	HS 20-44	Inventory	0.735	0.735	0.000	Yes	Yes	1.498	1.422
12	TrainingBridge2	HS 20-44	Operating	1.227	1.227	0.000	Yes	Yes	1.498	1.422

Comparison summary:

Acceptable row data = 10 of 14 (71%)  
 Unacceptable row data = 4 of 14 (29%)  
 Comparison failures = 0 of 14 (0%)

Buttons: Show all within tolerance, Show all outside tolerance, Show comparison failure, Show all, Run level 2 compare, Close

### Level 2 Comparison

Click ‘Run level 2 compare’ in the Level 1 Comparison window to run a level 2 comparison on the selected bridges. This will open the Level 2 Comparison window which displays the results of the comparison at the controlling location of each member in a bridge. If the controlling location or limit state is different between the two datasets, the value for that column will be shown in red. If the rating/design factor percent change between the two datasets is greater than the RF/DR tolerance specified in the Dataset Comparison Setting window, the value for that column will be shown in red.

To view the settings for this comparison, click the ‘View comparison setting’ button in the top right corner of the window. This will open the Dataset Comparison Setting window in read-only mode.

To export the results to a CSV file, click the ‘Export to CSV’ button and select a location to save the file.

The Comparison Summary in the bottom left shows a summary of the level 2 results. If either dataset 1 or dataset 2 does not have a rating/design factor, the comparison will be counted as a failure. If the limit state or controlling location are different between dataset 1 and dataset 2 or the rating/design factor percent change is not within the specified tolerance, the comparison will be counted as unacceptable. If the limit state and location are both the same and the rating/design factor percent change is within the specified tolerance, the comparison will be counted as acceptable.

The ‘Show all within tolerance’, ‘Show all outside tolerance’, ‘Show comparison failure’, and ‘Show all’ buttons at the bottom of the Level 2 Comparison window can be used to filter the data grid by rating/design factor percent change tolerance.

Level 2 Comparison

RF or DR Tolerance(%): 1.0

ID	Bridge ID	Super structure def...	Member	Vehicle	Rating or design	Dataset 1 RF or DR	Dataset 2 RF or DR	Percent change (%)	Location same?	Limit state same?
1	2205790-2020	07/27/2020 Span 1	G1	HS 20-44	Inventory	0.797	0.584	-26.680	No	No
2	2205790-2020	07/27/2020 Span 1	G1	HS 20-44	Operating	1.574	0.976	-38.004	No	No
3	2205790-2020	07/27/2020 Span 1	G2	HS 20-44	Inventory	0.823	0.823	0.000	Yes	Yes
4	2205790-2020	07/27/2020 Span 1	G2	HS 20-44	Operating	1.374	1.374	0.000	Yes	Yes
5	2205790-2020	07/27/2020 Span 1	G3	HS 20-44	Inventory	0.823	0.823	0.000	Yes	Yes
6	2205790-2020	07/27/2020 Span 1	G3	HS 20-44	Operating	1.374	1.374	0.000	Yes	Yes
7	2205790-2020	07/27/2020 Span 1	G5	HS 20-44	Inventory	1.005	1.005	0.000	Yes	Yes
8	2205790-2020	07/27/2020 Span 1	G5	HS 20-44	Operating	1.679	1.679	0.000	Yes	Yes
9	2205790-2020	07/27/2020 Span 1	G6	HS 20-44	Inventory	0.823	0.823	0.000	Yes	Yes

Comparison summary:

Acceptable row data = 34 of 38 (89%)  
 Unacceptable row data = 4 of 38 (11%)  
 Comparison failures = 0 of 38 (0%)

Buttons: Show all within tolerance, Show all outside tolerance, Show comparison failure, Show all, Run level 3 compare, Close

### Level 3 Comparison

If the ‘Generate Level 3 Analysis’ checkbox was selected for both dataset 1 and dataset 2, a level 3 comparison can be generated. Click ‘Run level 3 compare’ in the Level 2 Comparison window to run a level 3 comparison on the selected members. This will open the Level 3 Comparison window which displays the results of the comparison at the point of interest level. If the capacity, dead load, live load, or rating/design factor percent change between dataset 1 and dataset 2 are greater than the respective tolerances specified in the Dataset Comparison Setting window, the value for that column will be shown in red.

To view the settings for this comparison, click the ‘View comparison setting’ button in the top right corner of the window. This will open the Dataset Comparison Setting window in read-only mode.

To export the results to a CSV file, click the ‘Export to CSV’ button and select a location to save the file.

The ‘Show data at’ radio buttons can be used to toggle the level 3 data to show comparisons of the controlling rating/design factor of the bridge, superstructure def. or member.

The Comparison Summary in the bottom left shows a summary of the level 3 results. If either dataset 1 or dataset 2 does not have a rating/design factor, the comparison will be counted as a failure. If the rating/design factor percent change is not within the specified tolerance, the comparison will be counted as unacceptable. If the rating/design factor percent change is within the specified tolerance, the comparison will be counted as acceptable.

The ‘Show all within tolerance’, ‘Show all outside tolerance’, ‘Show comparison failure’, and ‘Show all’ buttons at the bottom of the Level 3 Comparison window can be used to filter the data grid by rating/design factor percent change tolerance.

Level 3 Comparison

Capacity Tolerance(%): 1.0 DL Tolerance(%): 1.0 LL Tolerance(%): 1.0 RF or DR Tolerance(%): 1.0

Show data at

Bridge level  Superstructure def. level  Member level

ID	Bridge ID	Super structure def...	Member	Vehicle	Rating or design	Span - % of span/...	Action - unit	Unfact. DL change...	Unfact. LL change (...)	Unfact. capacity ch...	RF or DR change (%)
1	2205790-2020	07/27/2020 Span 1	G1	HS 20-44	Inventory	1-64.3%	Shear	0.000	0.000	84.295	-87.205
2	2205790-2020	07/27/2020 Span 1	G1	HS 20-44	Operating	1-64.3%	Shear	0.000	0.000	84.295	-87.205
3	2205790-2020	07/27/2020 Span 1	G9	HS 20-44	Inventory	1-50.0%	Overload	0.000	0.000	0.000	0.000
4	2205790-2020	07/27/2020 Span 1	G9	HS 20-44	Operating	1-50.0%	Overload	0.000	0.000	0.000	0.000
5	23A141	Existing Structure	Girder 4	HS 20-44	Inventory	2-98.7%	Shear	0.000	0.000	97.751	-99.368
6	23A141	Existing Structure	Girder 4	HS 20-44	Operating	2-98.7%	Shear	0.000	0.000	97.751	-99.368
7	23A141	Existing Structure	Girder 6	HS 20-44	Inventory	2-60.0%	Flexure	0.000	0.000	0.000	0.000
8	23A141	Existing Structure	Girder 6	HS 20-44	Operating	2-60.0%	Flexure	0.000	0.000	0.000	0.000
9	M0349-RCSS-0864...	SPAN1	G1	HS 20-44	Inventory	1-8.8%	Shear	0.000	0.000	0.000	0.000

Comparison summary:

Acceptable row data = 1992 of 1980 (96%)  
 Unacceptable row data = 88 of 1980 (4%)  
 Comparison failures = 0 of 1980 (0%)

Show all within tolerance Show all outside tolerance Show all Close