
AASHTOWare BrDR 7.5.0
Feature Tutorial
ROUTE1 – Routing Example

ROUTE1 –Routing Example

Introduction

This example demonstrates using the Routing feature in BrDR to perform a batch analysis on a group of bridges located on a route using vehicles that are not stored in the BrDR library.

This routing feature was developed specifically for the Minnesota Department of Transportation and has been made available to all BrDR users. The routing feature was developed to interface with Minnesota's permit and routing system in which a permit office creates an electronic file that contains a list of bridges along a route and the vehicle(s) that should be used in the analysis of those bridges. The vehicle(s) in this file are typically oversize/overweight trucks that are requesting a permit to travel on specific routes. These vehicles do not have to be stored in the BrDR library. A rating engineer receives this electronic file and uses the routing feature in BrDR to analyze the bridges on the route. An electronic results file is created after the route is analyzed and sent back to the permit office. This routing feature is not meant to replace the batch analysis of bridges from the Bridge Explorer.

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Routing file Specifications

The Routing feature in BrDR requires a routing request file that contains a list of bridges on the route and a description of the vehicles to be used in the analysis. The routing request file should be an XML file conforming to the following specifications. Descriptions of individual wheels composing of an axle are only supported for non-standard gage vehicles.

XML Tag	Description
<routing>	Indicates the beginning of the routing information
<file_version>	Indicates the version of the routing request file. Should be 1.0.
<permit_application_number>	Permit application number for tracking purposes
<requested_by>	Name of person submitting the routing request file
<application_timestamp>	Time that the routing request file was created
<structural_analysis_type>	Type of structural analysis. Should be either "StandardGage" Or "NonStandardGage"
<comment >	Indicates start of comments
<route>	Indicates start of route
<bridge_list>	Indicates start of list of bridges on route
<bridge>	Indicates start of data for a bridge on the route
<bridge_id>	Agency bridge ID
<route_id>	Route ID
<analysis_method_type>	Indicates the analysis method type (LFR, LRFR, MemberAlt)
<rating_settings>	Indicates start of rating settings
<routing_vehicle_list>	Indicates start of list of vehicles for analysis
<vehicle_description>	Indicates start of data for a vehicle
<adjacent_lane_vehicle_description>	Indicates start of data for an adjacent lane vehicle
<name>	Name of vehicle
<vehicle_gage_type>	Type of vehicle gage. Should be either "StandardGage" or "NonStandardGage"
<controlling_rating_level>	Indicates rating factor to be checked to determine pass or fail status of rating. Acceptable values include Inventory, Operating, Legal_Inventory, Legal_Operating, Permit_Inventory, Permit_Operating, Legal and Permit.
<single_lane_ind>	Indicates if single lane distribution factors should be used in analysis. Should be either "TRUE" or "FALSE".
<impact>	User defined impact value for the vehicle.
<units>	Indicates start of list of units for the vehicle
<weight_unit>	Unit for the axle or wheel weight. Should be "kip", "pound", "kilonewton", or "newton".
<gage_distance_unit>	Unit for the gage distance. Should be "foot", "inch", "meter", or millimeter".
<wheel_contact_width_unit>	Unit for the wheel contact width. Should be "foot", "inch", "meter", or "millimeter".
<dist_first_wheel_unit>	Unit for the distance to first wheel. Should be "foot", "inch", "meter", or "millimeter".
<axle_spacing_unit>	Unit for the axle spacing. Should be "foot", "inch", "meter", or millimeter".

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<wheel_spacing_unit>	Unit for the wheel spacing. Should be “foot”, “inch”, “meter”, or “millimeter”
<axle_list>	Indicates start of list of axles belonging to the vehicle
<axle_description>	Indicates start of data for an axle
<weight>	Weight of the axle
<gage_distance>	Gage distance of the axle
<wheel_contact_width>	Wheel contact width
<dist_first_wheel >	Distance from the centerline of the vehicle to the first wheel of the axle
<axle_spacing>	Constant spacing to this axle from the preceding axle
<minimum_axle_spacing>	Minimum spacing to this axle from the preceding axle. Not required if constant axle spacing was specified.
<maximum_axle_spacing>	Maximum spacing to this axle from the preceding axle. Not required if constant axle spacing was specified.
<wheel_list>	Indicates start of list of wheels belonging to the axle
<wheel_description >	Indicates start of data for a wheel
<weight>	Weight of the wheel
<wheel_contact_width>	Wheel contact width
<wheel_spacing>	Spacing to this wheel from the preceding wheel
<analysis_vehicle_summary>	Indicates start of rating vehicle list(s)
<xx_vehicle_list>	Indicates start of rating category vehicle list. The name and number of vehicle lists will vary depending on the analysis method type
<vehicle>	Name of vehicle to be analyzed in rating category. Note: Vehicle must be defined in the above routing_vehicle_list
<adjacent_vehicle>	Adjacent Vehicle Name. Note: Adjacent vehicle must be defined in the above routing_vehicle_list

The following sample routing request file, **RoutingFile.xml**, is delivered with BrDR 7.5.0.

```
<?xml version = "1.0"?>
<!DOCTYPE routing>

<!--Routing file: RoutingFile.XML-->
<!--Please do not edit this file-->

<routing>
  <file_version>1.0</file_version>
  <permit_application_number>0589000897</permit_application_number>
  <requested_by>John Smith</requested_by>
  <application_timestamp>5/30/2001 13:29:32</application_timestamp>
  <structural_analysis_type>StandardGage</structural_analysis_type>
  <min_allowable_rating_factor>1.0</min_allowable_rating_factor>
  <route>
    <bridge_list>
      <bridge>
        <bridge_id>TrainingBridge1</bridge_id>
        <route_id>US 0123</route_id>
      </bridge>
      <bridge>
        <bridge_id>RCTrainingBridge1</bridge_id>
        <route_id>US 0123</route_id>
      </bridge>
    </bridge_list>
  </route>
</routing>
```

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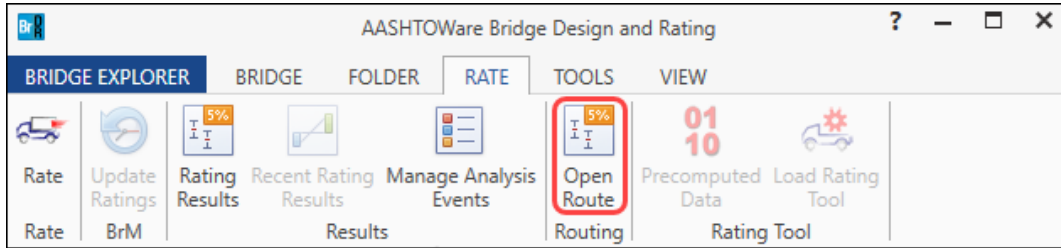
```
</bridge>
<bridge>
  <bridge_id>TrainingBridge2</bridge_id>
  <route_id>MN 6789</route_id>
</bridge>
</bridge_list>
<comment>Comments go here</comment>
</route>
<analysis_method_type><![CDATA[LFD]]></analysis_method_type>
<rating_settings>
  <routing_vehicle_list>
    <!--Vehicle 1-->
    <routing_vehicle>
      <name>Vehicle 1</name>
      <controlling_rating_level>Inventory</controlling_rating_level>
      <single_lane_ind>TRUE</single_lane_ind>
      <impact>1.10</impact>
      <units>
        <weight_unit>kip</weight_unit>
        <gage_distance_unit>foot</gage_distance_unit>
        <wheel_contact_width_unit>inch</wheel_contact_width_unit>
        <axle_spacing_unit>foot</axle_spacing_unit>
      </units>
      <axle_list>
        <!--Axle 1-->
        <axle>
          <weight>20</weight>
          <gage_distance>6</gage_distance>
          <wheel_contact_width>20</wheel_contact_width>
        </axle>
        <!--Axle 2-->
        <axle>
          <weight>25</weight>
          <gage_distance>6</gage_distance>
          <wheel_contact_width>20</wheel_contact_width>
          <axle_spacing>14</axle_spacing>
        </axle>
        <!--Axle 3-->
        <axle>
          <weight>25</weight>
          <gage_distance>6</gage_distance>
          <wheel_contact_width>20</wheel_contact_width>
          <minimum_axle_spacing>14</minimum_axle_spacing>
          <maximum_axle_spacing>30</maximum_axle_spacing>
        </axle>
      </axle_list>
    </routing_vehicle>
    <!--Vehicle 2-->
    <routing_vehicle>
      <name>Vehicle 2</name>
      <controlling_rating_level>Operating</controlling_rating_level>
      <single_lane_ind>FALSE</single_lane_ind>
      <impact>1.15</impact>
```

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```
<units>
  <weight_unit>kip</weight_unit>
  <gage_distance_unit>foot</gage_distance_unit>
  <wheel_contact_width_unit>inch</wheel_contact_width_unit>
  <axle_spacing_unit>foot</axle_spacing_unit>
</units>
<axle_list>
  <!--Axle 1-->
  <axle>
    <weight>15</weight>
    <gage_distance>6</gage_distance>
    <wheel_contact_width>20</wheel_contact_width>
  </axle>
  <!--Axle 2-->
  <axle>
    <weight>25</weight>
    <gage_distance>6</gage_distance>
    <wheel_contact_width>20</wheel_contact_width>
    <axle_spacing>14</axle_spacing>
  </axle>
  <!--Axle 3-->
  <axle>
    <weight>30</weight>
    <gage_distance>6</gage_distance>
    <wheel_contact_width>20</wheel_contact_width>
    <axle_spacing>14</axle_spacing>
  </axle>
  <!--Axle 4-->
  <axle>
    <weight>30</weight>
    <gage_distance>6</gage_distance>
    <wheel_contact_width>20</wheel_contact_width>
    <axle_spacing>14</axle_spacing>
  </axle>
</axle_list>
</routing_vehicle>
</routing_vehicle_list>
<analysis_vehicle_summary>
  <inventory_vehicle_list >
    <vehicle><![CDATA[Vehicle 1]]></vehicle>
    <vehicle><![CDATA[Vehicle 2]]></vehicle>
  </inventory_vehicle_list>
  <operating_vehicle_list>
    <vehicle><![CDATA[Vehicle 1]]></vehicle>
    <vehicle><![CDATA[Vehicle 2]]></vehicle>
  </operating_vehicle_list>
  <legal_operating_vehicle_list />
  <permit_inventory_vehicle_list />
  <permit_operating_vehicle_list>
  </permit_operating_vehicle_list>
</analysis_vehicle_summary>
</rating_settings>
</routing>
```

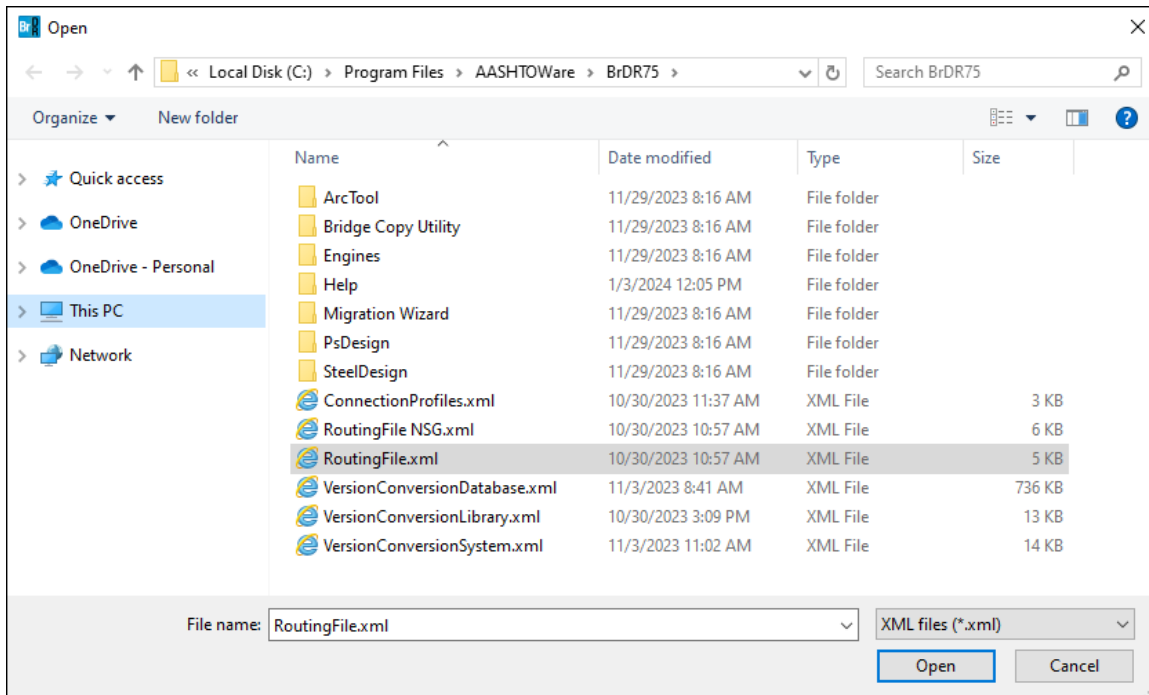
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The Routing feature can be accessed by selecting the **Open Route** button from the **Routing** group of the **RATE** ribbon.



A file browser window will open to select the routing request file .

Select the sample routing file, **RoutingFile**, provided with the BrDR installation, and click **Open**.



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After selecting the routing file, the **Routing** window will open.

Routing

Permit application number: 589000897

Requested by: John Smith

Bridges Vehicles Rating results

Analysis setting: XML input View

BID	Bridge database					Route ID	Travel direction	
	Bridge ID	NBI structure ID	Route number	Number of structures	Completely defined			
> 1	TrainingBridge1	TrainingBridge1	0051	1	<input checked="" type="checkbox"/>	US 0123	DownMilepost	
11	RCTrainBridge1	RCTrainBridge1	-1	1	<input checked="" type="checkbox"/>	US 0123	DownMilepost	
2	TrainingBridge2	TrainingBridge2	-1	1	<input checked="" type="checkbox"/>	MN 6789	DownMilepost	

Process route...

Close

The **Bridges** tab lists the bridges on the route. If the **NBI Structure ID** is listed as **NA** that means this bridge is not present in the database and the bridge will not be analyzed.

The **Number of Structures** column displays the number of structures within the bridge that are marked as **Existing** that contain member alternatives that are also marked as **Existing**. Structures and member alternatives marked as **Existing** are considered in a batch analysis. Each member alternative marked as **Existing** will be analyzed using the **Default Rating Method** in the member alternative window.

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The **Vehicles** tab lists the vehicles contained in the routing request file.

The screenshot shows a software window titled "Routing" with a close button (X) in the top right corner. Below the title bar, there are two input fields: "Permit application number:" with the value "589000897" and "Requested by:" with the value "John Smith". Below these fields are three tabs: "Bridges", "Vehicles", and "Rating results". The "Vehicles" tab is selected and displays a table with the following data:

Vehicle	Controlling rating level	Single lane	Impact	Comment
▶ Vehicle 1	Inventory	Yes	1.1	
Vehicle 2	Operating	No	1.15	

At the bottom right of the table area, there is a button labeled "View vehicle...". At the bottom right of the entire window, there is a button labeled "Close".

Click **Close** to close this window.

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Before analyzing the bridges in the given sample routing file, make sure that the bridges are not marked as **Template**. For example, open **TrainingBridge2 (BID2)**, double-click on **TrainingBridge2** from the **Bridge Workspace** to open the **Bridge** window. Uncheck the **Template** checkbox to be able to perform rating analysis on this bridge from the **Bridge Explorer**.

TrainingBridge2

Bridge ID: TrainingBridge2 NBI structure ID (8): TrainingBridge2

Template Bridge completely defined

Bridge Workspace

- Superstructure
- Culverts
- Substructures

Description Description (cont'd) Alternatives Global reference point Traffic Custom agency fields

Name: Training Bridge 2(LRFD) Year built: 1996

Description: Two-span continuous composite I Girder

Location: N/A Length: ft

Facility carried (7): N/A Route number: -1

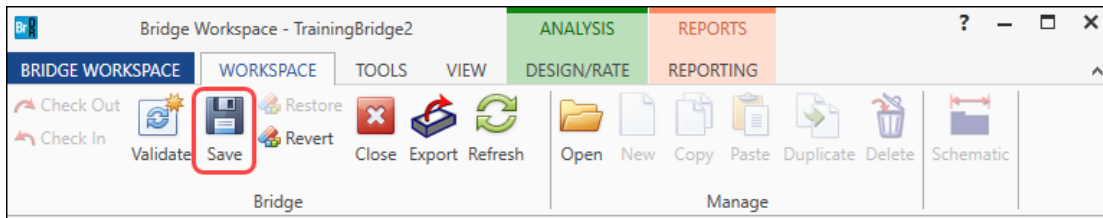
Feat. intersected (6): N/A Mi. post:

Default units: US Customary

Bridge association... BrR BrD BrM

OK Apply Cancel

Click **OK** to apply the changes and select **Save** from the **Bridge** group of the **WORKSPACE** ribbon to save the changes to the bridge and close the bridge.



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Navigate back to the **Routing** window and select the **Process route...** button on the **Bridges** tab to perform the analysis. The analysis progress window will appear, displaying the bridges that are being rated. After the analysis is complete, the results can be viewed on the **Rating results** tab. See below.

Routing

Permit application number: 589000897

Requested by: John Smith

Bridges Vehicles Rating results

Filter results: Pass Fail Exceptions Show All Only Show Controlling: Operating Inventory

BrDR BID	Bridge ID	NBI structure ID	Route ID	Completely defined	Operating RF	Inventory RF	Results	Code	Code explanation	Controlling impact
1	TrainingBridge1	TrainingBridge1	US 0123	<input checked="" type="checkbox"/>	2.48	1.48	Pass	1	Pass, no restrictions	1.1
1	TrainingBridge1	TrainingBridge1	US 0123	<input checked="" type="checkbox"/>	1.17	0.70	Pass	1	Pass, no restrictions	1.15
11	RCTrainingBridge1	RCTrainBridge1	US 0123	<input checked="" type="checkbox"/>	1.89	1.13	Pass	1	Pass, no restrictions	1.1
11	RCTrainingBridge1	RCTrainBridge1	US 0123	<input checked="" type="checkbox"/>	1.54	0.93	Pass	1	Pass, no restrictions	1.15
2	TrainingBridge2	TrainingBridge2	MN 6789	<input checked="" type="checkbox"/>	1.79	1.07	Pass	1	Pass, no restrictions	1.1
2	TrainingBridge2	TrainingBridge2	MN 6789	<input checked="" type="checkbox"/>	1.06	0.63	Pass	1	Pass, no restrictions	1.15

View results... Create routing results file... View routing results file...

Close

The **Filter results** checkboxes can be used to filter the results displayed on this tab. The **View results...** button will open windows containing the bridge, structure and member rating results for bridges currently selected in the grid.

The **Create routing results file...** button can be used to create an XML file containing the results of the routing analysis.

The **View routing results file...** button can be used to open an XML file containing the results of the routing analysis as shown below:

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0589000897: 5/30/2001 1:29:32 PM

Permit Application Number: 0589000897

Application Date: 5/30/2001 1:29:32 PM

Requested By: John Smith

Process Date: 1/17/2023 10:43:35 AM

Processed By: bridge

ROUTING RESULTS OUTPUT

BrDR BID	Bridge ID	Route ID	Code	Description	Operating RF	Controlling Impact
1	TrainingBridge1	US 0123	1	Pass, no restrictions	2.47826506515778	1.1
1	TrainingBridge1	US 0123	1	Pass, no restrictions	1.16831926829237	1.15
11	RCTrainingBridge1	US 0123	1	Pass, no restrictions	1.88682490597308	1.1
11	RCTrainingBridge1	US 0123	1	Pass, no restrictions	1.54478747079099	1.15
2	TrainingBridge2	MN 6789	1	Pass, no restrictions	1.78678331807416	1.1
2	TrainingBridge2	MN 6789	1	Pass, no restrictions	1.05988158911806	1.15