Feature Tutorial

ROUTE1 – Routing Example

This example demonstrates using the Routing feature in BrR to perform a batch analysis on a group of bridges located on a route using vehicles that are not stored in the BrR library. The Routing feature is only available in BrR, it is not available in BrD.

This routing feature was developed specifically for the Minnesota Department of Transportation and has been made available to all BrR 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 BrR library. A rating engineer receives this electronic file and uses the routing feature in BrR 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.

The Routing feature in BrR 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.

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
<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
<routing_vehicle_list>	Indicates start of list of vehicles for analysis
<vehicle_description>	Indicates start of data for a vehicle
<name>	Name of vehicle
<controlling_rating_level>	Indicates rating factor to be checked to determine pass or fail status of rating. Should be either "Inventory" or "Operating".
<single_lane_ind>	Indicates if single lane distribution factors should be used in analysis. Should be either "TRUE" or "FALSE".
<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".
<axle_spacing_unit>	Unit for the axle 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
<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.

Future versions of BrR may support vehicles containing descriptions of the individual wheels composing an axle. In anticipation of this future capability, the routing request file may contain the following data to describe the individual wheels in an axle. If such data is found in a Version 1.0 routing request XML file, the routing interface in BrR Version 5.1 will identify the vehicle as a vehicle not currently supported and it will not be used in the analysis of the bridges on the route.

XML Tag	Description
<axle_list>	Indicates start of list of axles belonging to vehicle
<axle_description>	Indicates start of data for an axle
<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
<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.

The following sample routing request file, RoutingFile.xml, was delivered with BrDR 6.8.0.

```xml
<?xml version="1.0" ?>
  <!DOCTYPE routing (View Source for full doctype...)>
- <!-- Routing file: RoutingFile.XML   -->
- <!-- Generated by MnDOT Routing Interface for AASHTO Virtis   -->
- <!-- Wednesday, May 30, 2001, 13:29:32   -->
- <!-- 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>
  - <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>
          <bridge_id>TrainingBridge2</bridge_id>
          <route_id>MN 6789</route_id>
        </bridge>
      </bridge_list>
      <comment>Comments go here</comment>
    </route>
  - <routing_vehicle_list>
    - <!-- Vehicle 1   -->
    - <vehicle_description>
        <name>Vehicle 1</name>
        <controlling_rating_level>Inventory</controlling_rating_level>
        <single_lane_ind>TRUE</single_lane_ind>
      - <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_description>
            <weight>20</weight>
            <gage_distance>6</gage_distance>
            <wheel_contact_width>20</wheel_contact_width>
```

```
        </axle_description>
      - <!-- Axle 2   -->
      - <axle_description>
          <weight>25</weight>
          <gage_distance>6</gage_distance>
          <wheel_contact_width>20</wheel_contact_width>
          <axle_spacing>14</axle_spacing>
        </axle_description>
      - <!-- Axle 3   -->
      - <axle_description>
          <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_description>
      </axle_list>
    </vehicle_description>
  - <!-- Vehicle 2   -->
  - <vehicle_description>
      <name>Vehicle 2</name>
      <controlling_rating_level>Operating</controlling_rating_level>
      <single_lane_ind>FALSE</single_lane_ind>
    - <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_description>
          <weight>15</weight>
          <gage_distance>6</gage_distance>
          <wheel_contact_width>20</wheel_contact_width>
        </axle_description>
      - <!-- Axle 2   -->
      - <axle_description>
          <weight>25</weight>
          <gage_distance>6</gage_distance>
          <wheel_contact_width>20</wheel_contact_width>
          <axle_spacing>14</axle_spacing>
        </axle_description>
      - <!-- Axle 3   -->
      - <axle_description>
          <weight>30</weight>
          <gage_distance>6</gage_distance>
          <wheel_contact_width>20</wheel_contact_width>
          <axle_spacing>14</axle_spacing>
```
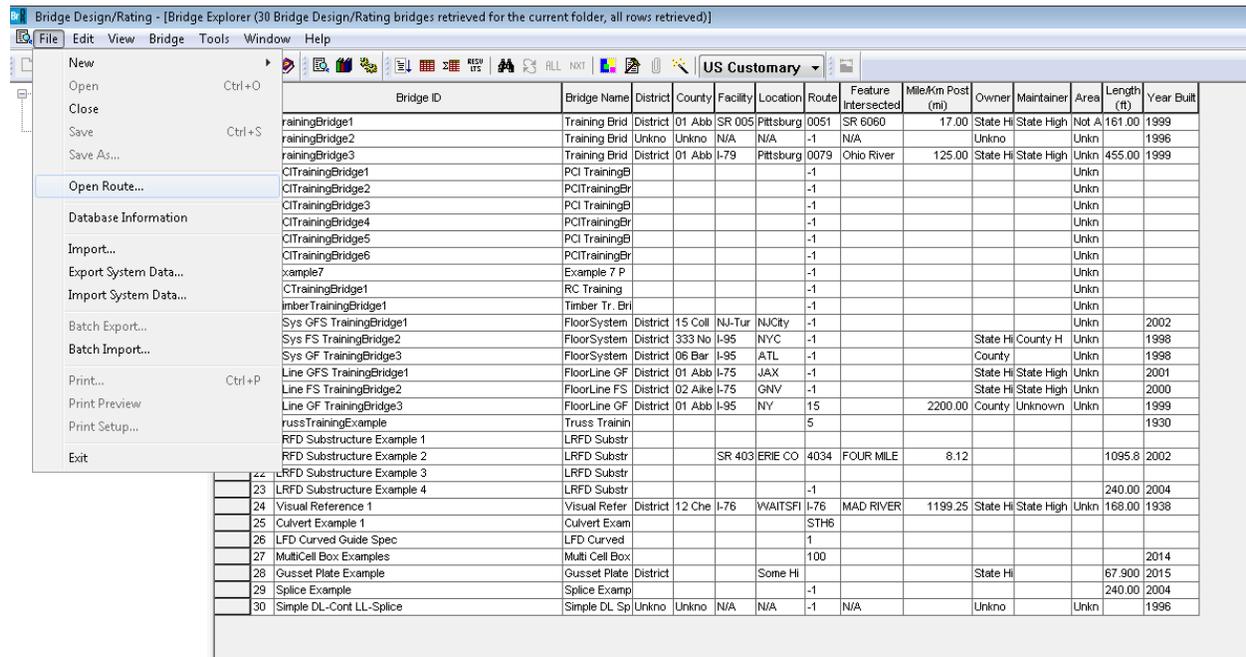
```
            </axle_description>
        - <!-- Axle 4   -->
        - <axle_description>
            <weight>30</weight>
            <gage_distance>6</gage_distance>
            <wheel_contact_width>20</wheel_contact_width>
            <axle_spacing>14</axle_spacing>
          </axle_description>
        </axle_list>
      </vehicle_description>
    </routing_vehicle_list>
  </routing>
```
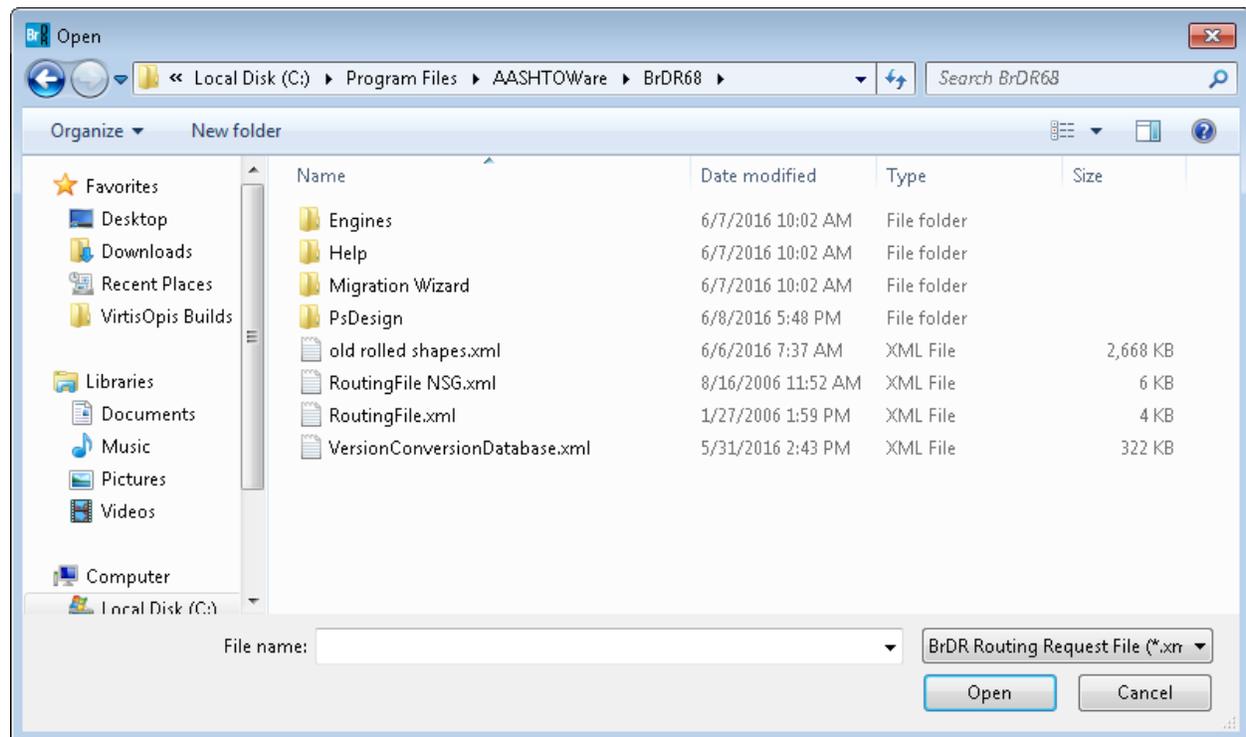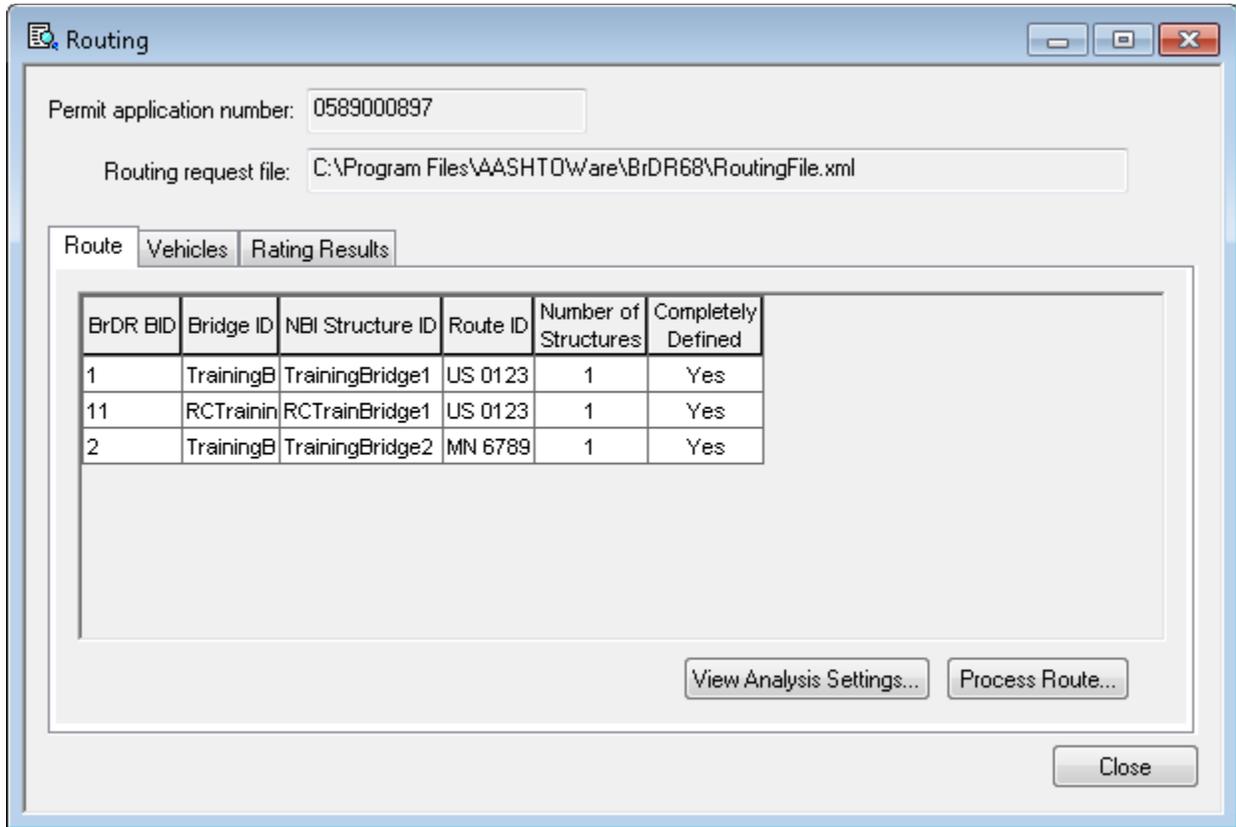
ROUTE1 - Routing Example

The Routing feature can be accessed by selecting "File/Open Route" from the menu in the Bridge Explorer.

A dialog will open in which you can select the name of the routing request file to open.

After you select the routing request file, the Routing window will appear.

The Route tab lists the bridges on the route. If the "NBI Structure ID" is listed as "NA" that means this bridge is not present in theVirtis 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 on the member alternative window.

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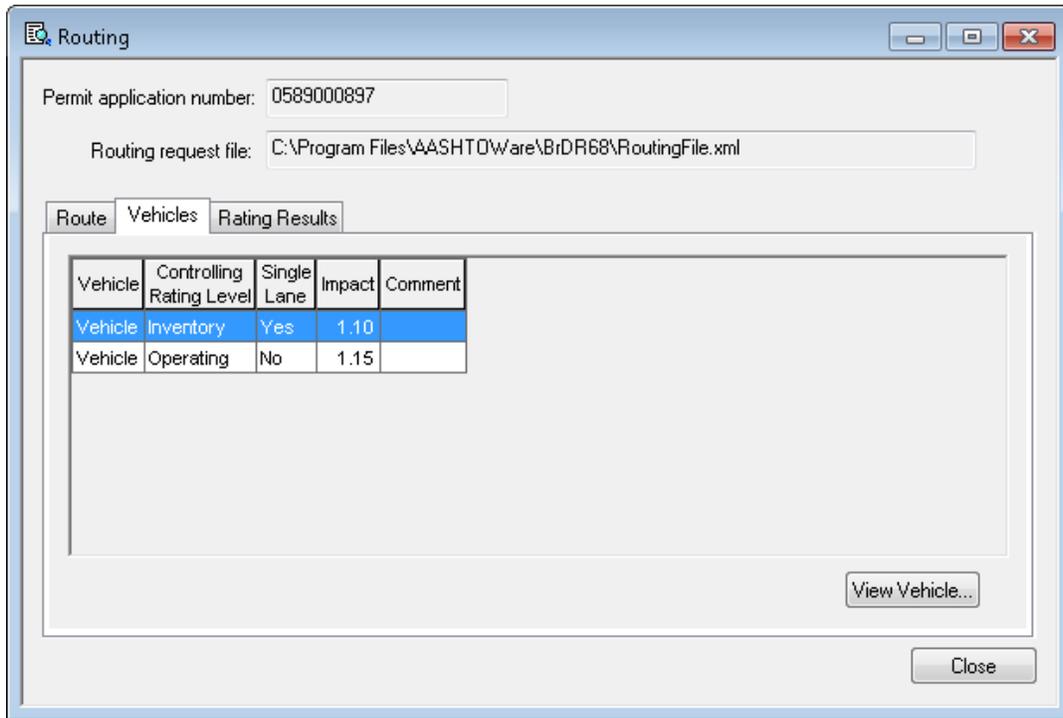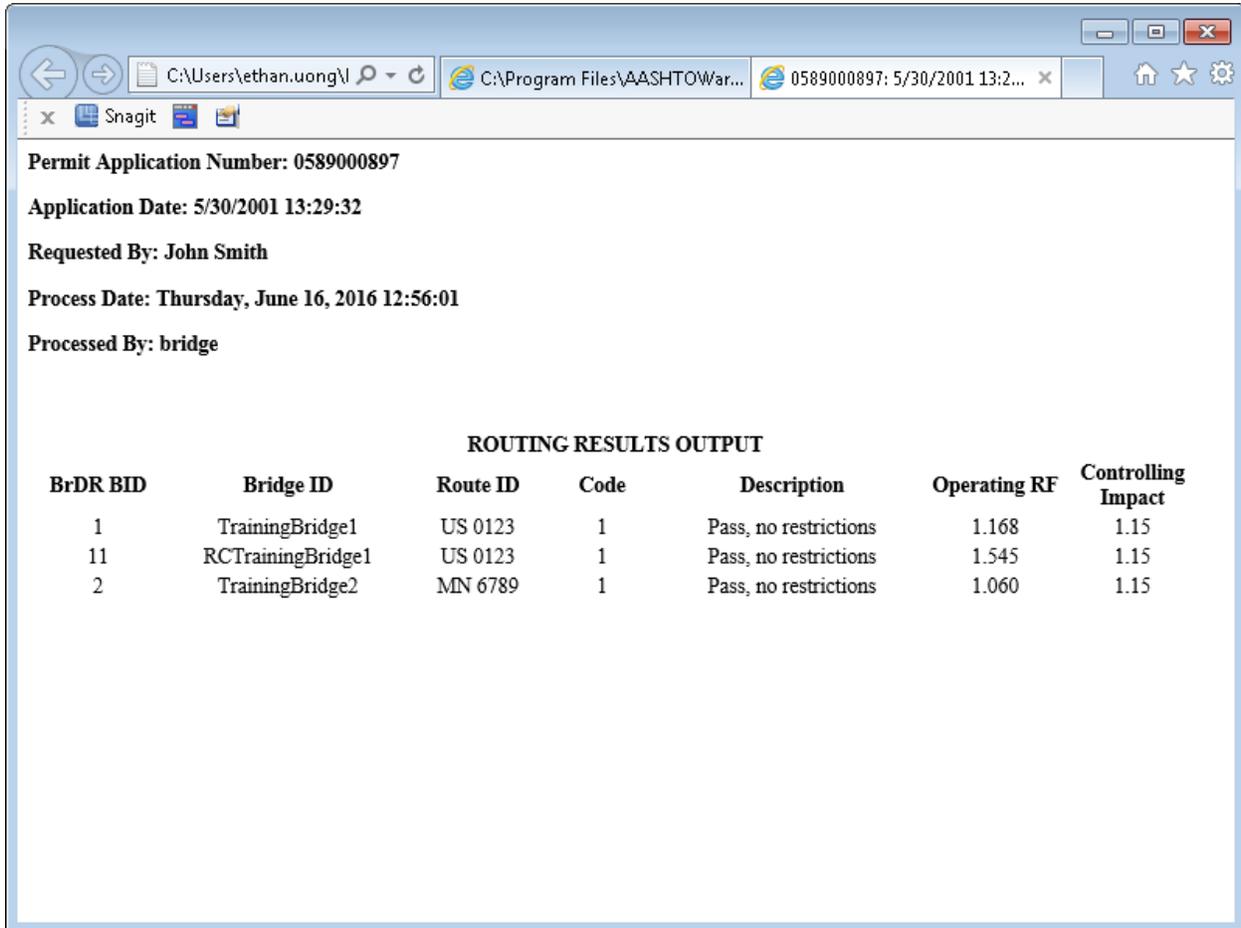

Select the "Process Route" button on the Route tab to perform the analysis. The analysis progress window will appear displaying the bridges that are being rated. After the analysis is complete, the results can be viewed on the Rating Results tab.
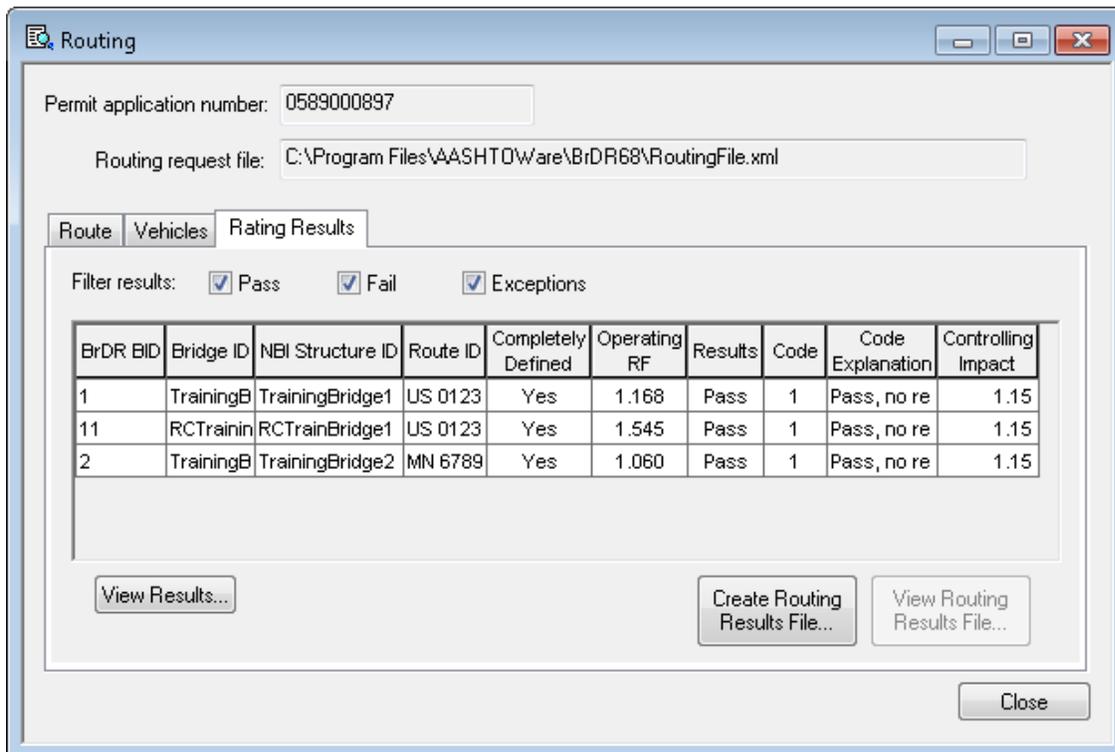
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The Filter results checkboxes can be used to filter the results displayed on this tab. The "View Results…" button will open windows containing the bridge, structure and member rating results for bridges currently selected in the grid.

The "Create Routing Results File…" button can be used to create an XML file containing the results of the routing analysis.