# The Resilience and Disaster Recovery (RDR) Tool Suite

## Run Checklist Version 2024.2.1

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Volpe developed the Resilience and Disaster Recovery (RDR) Tool Suite in support of the USDOT Office of Research, Development and Technology in collaboration with the Federal Highway Administration's Office of Natural Environment. The RDR Tool Suite enables transportation practitioners to assess the return-on-investment of resilient infrastructure across a range of potential hazard conditions to help prioritize resilience investments. This Run Checklist provides users with a comprehensive summary of input files and parameters to be reviewed before running an RDR analysis. It is complemented by the RDR Tool Suite Technical Documentation, User Guide, Quick Start Guide, and Reference Scenario Library.

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# RDR Run Checklist

This document provides a high-level overview of the input files required to run a custom analysis with the ROI Analysis Tool in the RDR Tool Suite. Several of these input files are also used by the Benefits Analysis Tool. For more details on the RDR input files, see the RDR Tool Suite User Guide.

## Required Files

The following input files are required before the tool suite can run an ROI analysis:

- ☐ Batch file (`run_rdr_full.bat`)
  **NOTE:** If using the RDR User Interface, this file is generated automatically.
  - ☐ Line 17 – Provide the full file path to the configuration file for the analysis.

- ☐ Configuration file (`{User-Defined}.config`, filename left up to user)
  The following parameters must be modified by the user before running a scenario. All other parameters in the configuration file have default values provided, which can be modified by the user as needed.
  **NOTE:** If using the RDR User Interface, this file is not required. Instead, a JSON configuration file (with file extension `.save`) is generated upon saving in the User Interface.
  - ☐ Line 18 – Provide the full file path to your input data folder.
  - ☐ Line 19 – Provide the full file path to where you want output data to be created. (RDR will automatically create this folder.)
  - ☐ Line 23 – Provide a text string identifier for your run; output files are labeled with this run ID.
  - ☐ Line 26 – Specify the beginning year of the ROI analysis period.
  - ☐ Line 28 – Specify the final year of the ROI analysis period.
  - ☐ Line 32 – Specify the base year for core model runs, corresponding to user-provided base year trip tables and core model run outputs.
  - ☐ Line 35 – Specify the future year for core model runs, corresponding to user-provided future year trip tables.
  - ☐ Line 53 – Specify the number of scenarios to run in the AequilibraE core model to build the regression model.
  - ☐ Line 106 – Provide the column name in the exposure analysis input files defining exposure level.
  - ☐ Line 143 – Specify the largest node ID in the user's network designating a centroid node.
  - ☐ Line 232 – Specify what type of ROI analysis (BCA, Regret, or Breakeven) to run.
  - ☐ Line 241 – Specify the year in which all monetary units are inputted and reported. All default values are provided in 2023 dollars.

- ☐ Model parameters file (`Model_Parameters.xlsx`)
  **NOTE:** If using the RDR User Interface, this file is not required. These parameters are instead included in the JSON configuration file.
  *EconomicScenarios tab*
  - ☐ Column A ("Economic Scenarios") – Enter name(s) of all possible future economic scenario(s).

  *Elasticities tab*

- ☐ Column A ("Trip Loss Elasticities") – Enter all possible numeric values (non-positive numbers) quantifying the change in trip demand due to increased travel time.

*ProjectGroups tab*

- ☐ Required columns – "Project Groups", "Project ID"
- ☐ Make sure every resilience project for the ROI Analysis Tool run is listed in Column B ("Project ID") and assigned to exactly one project group in Column A ("Project Groups").

*Hazards tab*

- ☐ Required columns – "Hazard Event", "Filename", "HazardDim1", "HazardDim2", "Event Probability in Start Year"
- ☐ List all hazard events considered by the ROI Analysis Tool run.
- ☐ If running a standard benefit-cost analysis (BCA) or breakeven analysis, hazard event probabilities must be provided. If running a regret analysis, set all probabilities to 1.

*RecoveryStages tab*

- ☐ Column A ("Recovery Stages") – List all hazard recovery stages as non-negative numbers (e.g., 0, 1, 2, …) for the ROI Analysis Tool run.

*FrequencyFactors tab*

- ☐ Column A ("Event Frequency Factors") – Enter all possible number(s) defining how the probability of each hazard event will increase or decrease year-on-year during the analysis period.

☐ Exposure analysis files (`{Filename}.csv` for each hazard event)

- ☐ Make sure there is a CSV file in the "`Hazards`" subdirectory of the input data folder with the designated filename (specified in the model parameters file above) for each hazard event.
- ☐ Required columns – "link_id", "from_node_id", "to_node_id", "Value" (or string corresponding to line 106 of the configuration file)
- ☐ Make sure all impacted road and transit network links are included. Centroid connectors and transit boarding/transfer links are not required to be included.

☐ Network attribute files (`node.csv` AND `{econ}{projgroup}.csv` for each economic scenario and project group)

*Node file*

- ☐ Make sure there is a CSV file named `node.csv` in the "`Networks`" subdirectory of the input data folder.
- ☐ Required columns – "node_id", "x_coord", "y_coord", "node_type"
- ☐ Confirm that node IDs are unique.
- ☐ Label centroid nodes in the network as "centroid" (case-sensitive) in the node_type column.
- ☐ Confirm that centroid nodes have smaller node IDs than non-centroid nodes.

*Link files*

- ☐ Make sure there is a CSV file in the "`Networks`" subdirectory of the input data folder for each project group-economic scenario combination.
- ☐ Required columns – "link_id", "from_node_id", "to_node_id", "directed", "length", "facility_type", "capacity", "free_speed", "lanes", "allowed_uses", "toll", "travel_time"

- ☐ Confirm that link IDs are unique. Confirm there are no missing values in the "link_id", "from_node_id", and "to_node_id" columns.
- ☐ Confirm the directed column is always equal to 1. Confirm the allowed_uses column is always equal to "c". Confirm the lanes column contains no zeroes.
- ☐ Confirm the units of the length column is miles, the units of the capacity column is vehicles / day / lane, the units of the free speed column is miles per hour, the units of the toll column is cents, and the units of the travel time column is minutes.
- ☐ If the RDR run includes trip tables for households owning vehicles and households without cars, "toll_nocar" and "travel_time_nocar" are also required columns.
- ☐ If using the default repair cost and/or repair time tables, make sure the facility type column aligns with the numerical codes described in the documentation (e.g., 100 for light rail service links, 600 for light rail boarding links, etc.).

☐ Demand files (`{econ}_demand_summed.omx` for each economic scenario)

- ☐ Make sure there is an open matrix (OMX) file in the "`AEMaster/matrices`" subdirectory of the input data folder for each economic scenario containing a trip table matrix labeled "matrix".
- ☐ If the RDR run includes trip tables for households owning vehicles and households without cars, the OMX file should include two trip tables matrices labeled "matrix" and "nocar" for each, respectively.

☐ SQLite database (`project_database.sqlite`)

- ☐ Confirm this file exists in the "`AEMaster`" subdirectory of the input data folder. Otherwise, copy the template SQLite database from the "`config`" directory to the "`AEMaster`" subdirectory.

☐ Base year core model runs file (`Metamodel_scenario_SP_baseyear.csv` OR `Metamodel_scenario_RT_baseyear.csv`)

- ☐ Create a row with base year core model run outputs for each hazard event-recovery stage combination. The Base Year Run Helper Tool can help you construct this file.
- ☐ Required columns – "hazard", "recovery", "trips", "miles", "hours"
- ☐ If calculating transit-specific metrics (calc_transit_metrics parameter in configuration file on line 74 set to 1), "lr_trips", "hr_trips", "bus_trips", "car_trips", "lr_miles", "hr_miles", "bus_miles", "car_miles", "lr_hours_wait", "hr_hours_wait", "bus_hours_wait", "lr_hours_enroute", "hr_hours_enroute", "bus_hours_enroute", and "car_hours" are also required columns. See documentation for more information.
- ☐ If using the Base Year Run Helper Tool, make sure there is a CSV file named `baseyear.csv` in the "`Networks`" subdirectory specifying network links for the base year and an OMX file named `baseyear_demand_summed.omx` in the "`AEMaster/matrices`" subdirectory specifying trip tables for the base year.

☐ Resilience projects files (`project_info.csv` AND `project_table.csv`)
*Project info file*

- ☐ Make sure there is a CSV file named `project_info.csv` in the "`LookupTables`" subdirectory of the input data folder.

- ☐ Required columns – “Project ID”, “Project Name”, “Asset”, “Project Cost”, “Project Lifespan”
- ☐ Make sure resilience project costs are provided in the dollar year units specified on line 241 of the configuration file.
- ☐ If using the optional “Annual Maintenance Cost” and “Redeployment Cost” columns, make sure “maintenance” and “redeployment” parameters, respectively, are set to True in the configuration file.

*Project table file*

- ☐ Make sure there is a CSV file named `project_table.csv` in the “`LookupTables`” subdirectory of the input data folder.
- ☐ Required columns – “link_id”, “Project ID”, “Category”
- ☐ If using default repair cost and/or repair time tables, confirm the Category column is either “Highway” “Bridge”, or “Transit”.
- ☐ Make sure all road and transit network links covered by the resilience project (e.g., including both road/passenger vehicle links and bus transit links) are included.
- ☐ If using the optional “Exposure Reduction” column for resilience project partial mitigation modeling, make sure “Manual” is specified on line 149 of the configuration file and the units used in the column match units of the exposure analysis files.

## Optional Files

The following input files provide optional functionality for a custom analysis:

- ☐ True shape file (`TrueShape.csv`)
  - ☐ If used, make sure there is a CSV file named `TrueShape.csv` in the “`LookupTables`” subdirectory of the input data folder.
  - ☐ Required columns – “link_id”, “WKT”
  - ☐ This file is required to generate the Map Dashboard in the Tableau workbook output by the RDR ROI Analysis Tool. True shape objects are recommended to be specified in LineString format for best performance.

- ☐ Link types look-up table (`link_types_table.csv`)
  - ☐ If used, make sure there is a CSV file named `link_types_table.csv` in the “`LookupTables`” subdirectory of the input data folder.
  - ☐ Required columns – “facility_type”, “alpha”, “beta”

- ☐ Exposure-disruption look-up table
  - ☐ If used, make sure “Manual” (or “Facility_Type_Manual”) is specified on line 101 of the configuration file for link availability approach and the full path of the CSV file is specified on line 116 of the configuration file.
  - ☐ Required columns for “Manual” – “min_inclusive”, “max_exclusive”, “link_availability”
  - ☐ Required columns for “Facility_Type_Manual” – “facility_type”, “min_inclusive”, “max_exclusive”, “link_availability”

- ☐ Exposure-damage look-up table

- ☐ If used, make sure “Manual” is specified on line 187 of the configuration file for exposure damage approach and the full path of the CSV file is specified on line 192 of the configuration file.
- ☐ Required columns – “Asset Type”, “min_exposure”, “max_exposure”, “Damage (%)”

☐ Repair cost look-up table

- ☐ If used, make sure “User-Defined” is specified on line 199 of the configuration file for repair cost approach and the full path of the CSV file is specified on line 208 of the configuration file.
- ☐ Required columns – “Asset Type”, “Facility Type”, “Damage Repair Cost”, “Total Repair Cost”
- ☐ Make sure costs are defined per lane-mile for all asset types except “Bridge”, which has costs defined per square foot.

☐ Repair time look-up table

- ☐ If used, make sure “User-Defined” is specified on line 215 of the configuration file for repair time approach and the full path of the CSV file is specified on line 219 of the configuration file.
- ☐ Required columns – “Asset Type”, “min_inclusive”, “max_exclusive”, “repair_time”

## RDR Input Validation Helper Tool

☐ Run the Input Validation Helper Tool from the “`helper_tools`” subfolder of the RDR directory (e.g., “`C:\GitHub\RDR\helper_tools`”).

☐ Correct errors identified in the Input Validation Helper Tool log file.[1] Check ranges of values entered in input files for reasonability as summarized in the Input Validation Helper Tool CSV output file.

[1] Note that the Input Validation Helper Tool is not a comprehensive check of all possible user input errors. In particular, the script does not check for errors in the batch file, the configuration file, or optional input files.