

Bridge Fragility

Overview

This page is intended to help users get their own bridge fragilities into MAEviz. The information you will find in this document is:

- File Types and Format
- Field Descriptions

File Types and Format

There are two acceptable formats, comma separated value (CSV) and Extensible Markup Language (XML). The simplest way to get fragilities into MAEviz is the CSV format which will internally be changed to XML. Both formats will be explained in their own section after the field descriptions.

Field Descriptions

In this section we will provide the expected field name, a short description about the field, the type for the field, whether the field is informational (e.g. for display or perhaps later use), and if any field has a small finite number of acceptable input values, they will be specified in the Acceptable Values column of the table. One information field is the *Code* column which simply tells the user if the fragility was intended as a retrofit and if so, what type.

Field Name	Field Description	Field Type	Acceptable Values	Informational
ID	Unique numeric identifier in the fragility dataset	Integer	N/A	No
Author	Identifies the person(s) who provided each fragility set.	String	N/A	Yes
StructureType	Structure Type this fragility curve is designed for	String	N/A	Yes
Description	A textual description providing information about the derivation of this fragility curve set	String	N/A	Yes
GroundMotions	Ground motion records used for time-history analyses when constructing fragilities	String	N/A	Yes
Code	Design code for the fragility set	String	low - no retrofit, seat extender, steel jacket, Restrainer cables, Shear Key, Elastomeric Bearing	Yes
DamageType	The type of damage type this fragility represents	String	Structural	Yes
DemandType	The demand type required by the fragility, can include the period if applicable (e.g. 0.2 Sa)	String	PGA, PGV, PGD, Sa, Sd, Sv	No
DemandUnits	The units of the demand type	String	g (typically), could be other values if another demand type is specified	No
LimitStates	The limit states of the fragility curves, MAEviz expects 4 limit states. This tells MAEviz how many fragility curves to expect.	String	Slight: Moderate: Extensive: Complete	No
EquationType	The fragility equation type	Integer	1 - Lognormal distribution, 2 - Normal Distribution	No
Parameters	The number of fragility parameters present (should be 2 parameters per fragility, median and beta)	Integer	N/A	No

After the Parameters field, specify the fragility parameters for each curve. Each curve should have a pair of parameters and the keyword for the fields are the words Median and Beta followed by a number that specifies which curve the parameter belongs to. Number should start at zero so if we have 2 fragility curves, the following 4 additional fields would be in the file:

Median0, Beta0, Median1, Beta1, Median2, Beta2, Median3, Beta3

Example CSV File

Below is a sample CSV fragility for a bridge. The first row is column names, the second row is column types (reserved for later use, but currently just ignored) and the 3rd row is a set of 4 fragility curves for an MSC_Concrete bridge.

ID	Author	StructureType	Description	GroundMotions	Code	DamageType	DemandType	DemandUnits	LimitStates	EquationType	Parameters
Int	String	String	String	String	String	String	String	String	String	Int	Int
1	HAZUS	MSC_Concrete	As-built Fragility	Unknown	Low	Structural	pga	g	Slight: Moderate: Extensive: Complete	2	8

You can download the csv file [here](#).

Example XML File

Below is the XML version of the CSV file.

```

<fragility-dataset>
  <fragility-dataset-sets>
    <fragility-set>
      <fragility-set-properties Parameters="8" DemandUnits="g" Description="As-Built Fragility" DamageType="
Structural" EquationType="2" GroundMotions="Unknown" StructureType="MSC_Concrete" LimitStates="Slight:
Moderate: Extensive: Complete" Author="HAZUS" ID="1" DemandType="pga" Code="Low"/>
      <fragility-set-labels>
        <fragility-set-label>Slight</fragility-set-label>
        <fragility-set-label>Moderate</fragility-set-label>
        <fragility-set-label>Extensive</fragility-set-label>
        <fragility-set-label>Complete</fragility-set-label>
      </fragility-set-labels>
      <fragility-set-fragilities>
        <fragility-curve fragility-curve-median="0.6" fragility-curve-beta="0.6" fragility-curve-type="Normal"/>
        <fragility-curve fragility-curve-median="0.88" fragility-curve-beta="0.6" fragility-curve-type="Normal"
/>
        <fragility-curve fragility-curve-median="1.17" fragility-curve-beta="0.6" fragility-curve-type="Normal"
/>
        <fragility-curve fragility-curve-median="1.53" fragility-curve-beta="0.6" fragility-curve-type="Normal"
/>
      </fragility-set-fragilities>
    </fragility-set>
  </fragility-dataset-sets>
</fragility-dataset>

```

Conclusion

Now that you have some fragility data in MAEviz, the next step is to learn about applying those fragilities to bridges. This will be discussed in the [Bridge Fragility Mapping](#) page. We have purposefully kept a weak coupling between fragilities and bridges to provide users with the flexibility to apply the fragilities in either very simplistic ways or very complex ways through the fragility mapping.