



# **Epson Bridge Deflection Calculator Ver.1.0**

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**Revision History**

Rev. No.	Date	Page	Description
20250325	22025/03/25	ALL	New release

# 1. Introduction

## 1.1. Overview

"Epson Bridge Deflection Calculator" is software that calculates the displacement due to the response acceleration integral when a vehicle passes over a bridge. This software is provided free of charge to customers who are evaluating the acceleration sensor M-A352/552.

## 1.2. Functions

This software can do the following.

- Load acceleration data (CSV files)
- Load displacement reference data (CSV files)
- Display acceleration time series graphs
- Calculate and display displacement by integrating acceleration, and display graphs of displacement reference data

Note) It is recommended to compare with displacement reference data measured simultaneously with the acceleration sensor.

Note) Customers need to prepare both acceleration sensor data and displacement reference data.

- Calculate and display vehicle entry and exit times
- Export CSV files of the calculated displacement by integrating acceleration
- Output graph images

The acceleration integral displacement calculation with Bridge Deflection Calculator makes it easy to calculate the match with the reference displacement data from the measurement data and the vehicle entry/exit time, which is useful for measuring displacement due to deflection when a vehicle passes over a bridge.

## 1.3. System Requirements

This software requires the following operating environment.

Operating System	Windows11, Windows10 (64-bit) *1
Memory (recommended)	4 GB or higher
Storage Space	500 MB free storage space before installation

Note) Operating systems other than Windows11 and Windows10 (64-bit) have not been tested.

Note) If you are using a computer with low specifications and experience operational issues such as delayed plot updates, please use a computer with high specifications.

## 1.4. Software Installation

- 1) Please extract and decompress the compressed file "EpsonBridgeDeflectionCalculator\_Ver.1.0.zip" to any location.
- 2) The following folders and files will be created inside the folder "EpsonBridgeDeflectionCalculator\_Ver.1.0":
  - ① The "\_internal" folder containing libraries used by this software
  - ② The software executable file "EpsonBridgeDeflectionCalculator\_Ver.1.0.exe"
  - ③ The sample acceleration and displacement data file "sample.csv"
  - ④ The End User License Agreement file "EULA.txt"

## 1.5. Uninstalling the Software

To uninstall this software, please delete the "EpsonBridgeDeflectionCalculator\_Ver.1.0" folder.

## 2. Operation Procedure

### 2.1. Starting and Exiting

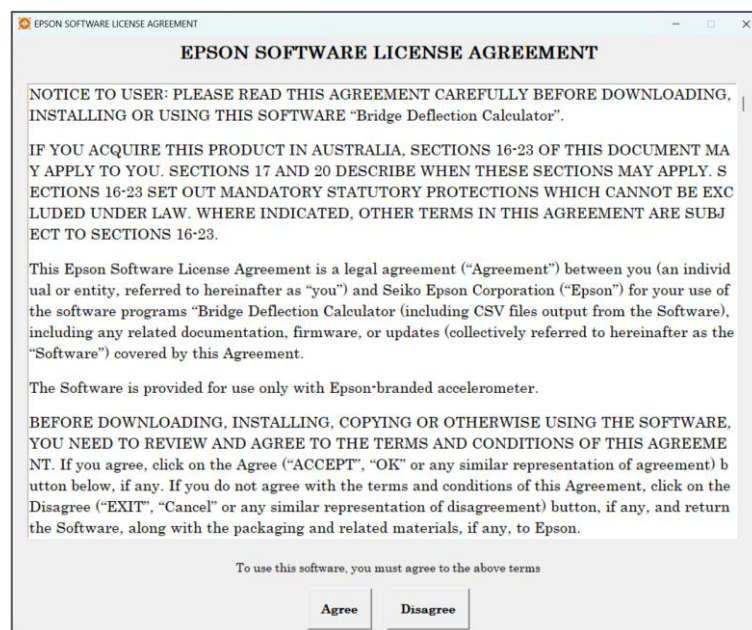
Double-click "EpsonBridgeDeflectionCalculator\_Ver.1.0.exe" to start this software. To exit the software, click the "x" button at the top right of the screen. While the software is running, a Windows command prompt window will be displayed, but it will also close when the software is exited.

Software Icon:



### 2.2. Operation Flow

When you start this software, the software license agreement will be displayed. Please review the content of the agreement and click the "Agree" button to use the software. After you agree to the software license agreement, it will not be displayed again.

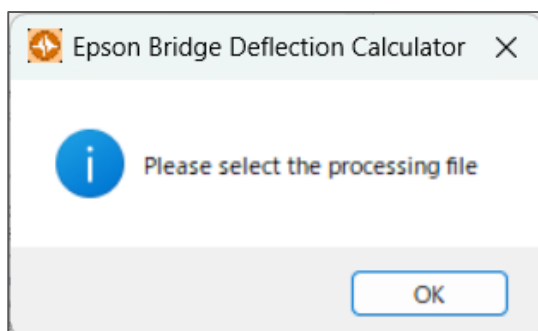


After agreeing to the software license agreement, 1) a dialog box will be displayed. Please click the "OK" button. 2) A file selection dialog will appear. Please select the CSV file to be used for the calculation of displacement by integrating acceleration.

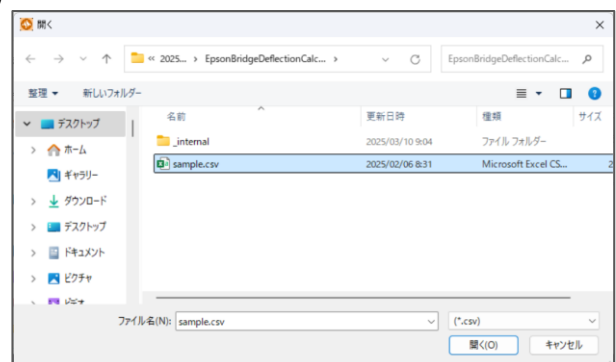
Note) If you click the cancel button in the file selection dialog, the software will exit.

Note) If you start the software again, 1) will be displayed.

1)

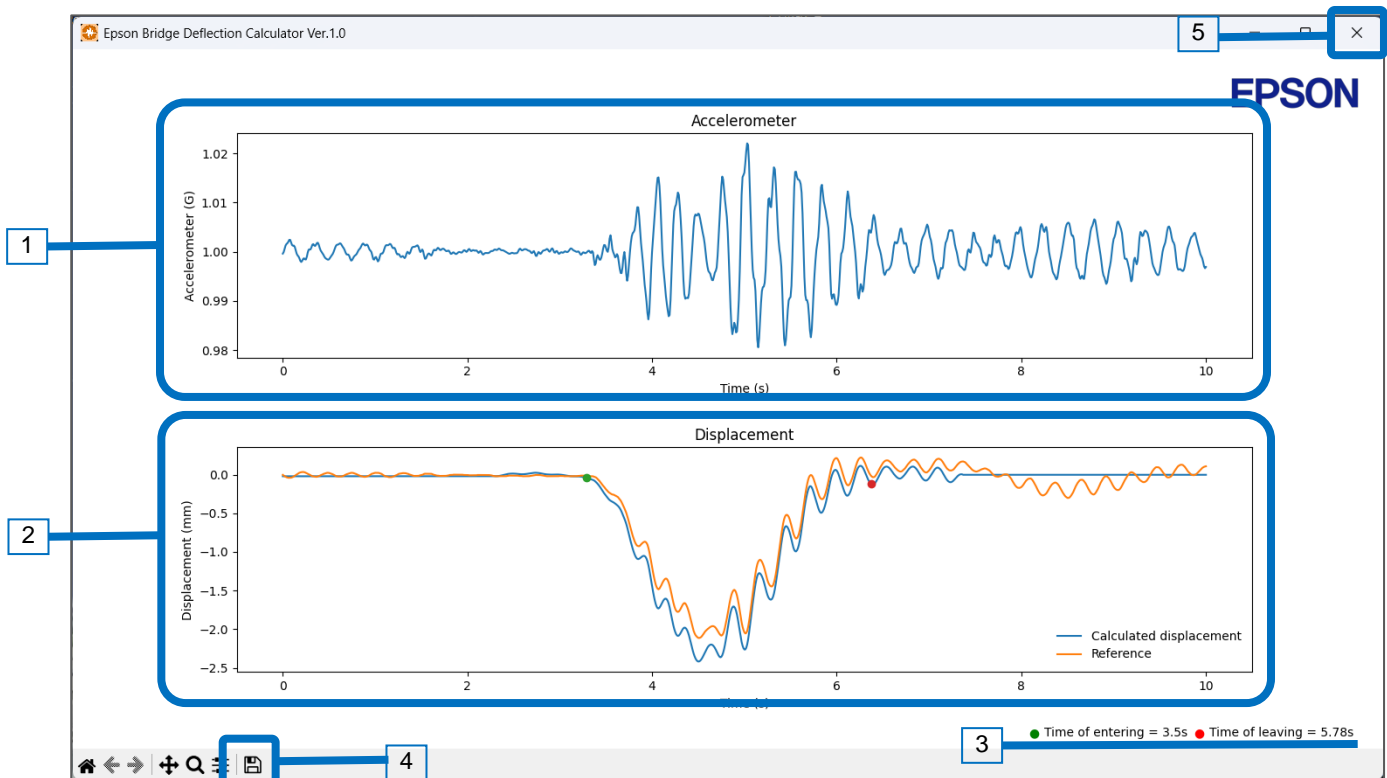


2)



## 2.3. How to read the screen

When you select the CSV file to input to the acceleration integral displacement calculation, the following screen will be displayed.



1	Accelerometer	Displays the acceleration time series waveform of the loaded CSV file.
2	Displacement	Displays the displacement waveform calculated from the acceleration data of the loaded CSV file. (Blue) Displays the displacement data of the loaded CSV file. (Orange)
3	Entry/Exit time	Displays the calculated displacement waveform or the entry/exit time calculated from the displacement data.
4	Graph image save	Saves the acceleration time series waveform graph and displacement waveform graph as png image files. Specify a folder and file name of your choice to save.
5	Software exit	Click the x button in the upper right corner of the screen to exit the software. A CSV file with displacement calculations from the acceleration data will be automatically created in the "EpsonBridgeDeflectionCalculator_Ver.1.0" folder.

### 3. CSV file format specificationsion Port

#### 3.1. Input CSV file.

The input CSV file specifications used by Bridge Deflection Calculator are as follows.

- Comma-separated csv format file
- Time unit: s, Acceleration input unit: G, Displacement unit: mm
- The header is a specified string as follows:

Column A (time): Time\_(s)

Column B (Acceleration data): Accel\_(G)

Column C (Displacement reference data): Ref\_(mm)

Note) This software will operate even if there is no displacement reference data

- The minimum data size is 331 rows
- The sampling rate should be 100sps.

	A	B	C	D
1	Time (s)	Accel (G)	Ref (mm)	
2	0.01	1.000246286	-0.003874	
3	0.02	1.000271678	-0.003874	
4	0.03	1.000193894	-0.003874	
5	0.04	0.999994636	-0.000577	
6	0.05	0.999886811	0.00014	
7	0.06	1.000002444	0.00014	
8	0.07	1.000140846	0.00014	
9	0.08	1.000030637	0.00014	
10	0.09	0.999756575	0.00014	
11	0.1	0.999650478	0.003439	

#### 3.2. Output CSV file

The output CSV file specifications used by Bridge Deflection Calculator are as follows.

- Comma-separated CSV format file
- The header is a specified string as follows:

Column A (time): Time(s)

Column B (displacement after acceleration integration): Displ. (mm)

- The file name will be "input file name" + Displ.

	A	B	C
1	Time(s)	Displ.(mm)	
2	0.01	-0.06705	
3	0.02	-0.06705	
4	0.03	-0.06705	
5	0.04	-0.06705	
6	0.05	-0.06705	
7	0.06	-0.06705	
8	0.07	-0.06705	
9	0.08	-0.06705	
10	0.09	-0.06705	
11	0.1	-0.06705	



## 4. Recommended installation and measurement conditions for the acceleration sensor

When using this software, the important points are the installation conditions and the setting requirements for the acceleration sensor in acceleration measurement. This page shows the measurement know-how required when measuring bridges using our quartz acceleration sensor M-A352/552.

### 4.1. Acceleration sensor installation conditions

No.	Acceleration sensor installation conditions	reason
1	Install monitoring points on the primary structure of the bridge	For steel bridges, it is recommended to mount them on the bridge girder.
2	Place monitoring points near the center of the span or between supports	The displacement response to vehicle loading is greatest and S/N is optimal
3	Install monitoring points away from bridge structures such as streetlights	Areas that are less affected by the inherent vibrations of streetlights and other structures, as well as wind-induced deflections provide a better S/N in the measurement area.
4	Install monitoring points away from bridge structures such as guardrails	Areas that are less influenced by the inherent vibrations of guardrails and other structures, as well as wind-induced deflections offer a better S/N in the measurement area.
5	Do not install monitoring points on structures associated with the vehicular-lane such as sidewalks	These structures may be structurally isolated from the main part of the bridge that supports vehicle loads, leading to inaccurate vehicle load measurement

### 4.2. Acceleration sensor setting conditions

No.	Acceleration sensor setting conditions	reason
1	At the monitoring points, apply vibration isolation to prevent unwanted vibrations from affecting the accelerometers, thereby isolating them from external vibration noise	—
2	Use the input data with a sampling rate of 100sps	—
3	It is desirable that the input data consist of acceleration measurements(A-352) with a bandwidth below 20Hz	—

### 4.3. Measurement conditions

No.	Measurement conditions	reason
1	This program has been validated using heavy vehicles of 5t or more	Lower vehicle loads may not produce a sufficient S/N in the response data
2	This program has been verified with measurement data from both steel and concrete bridges	This may not function correctly for all types of bridge structures.
3	The acceleration data should include periods without vehicles on the monitored bridge girder at both the start and end of the data set	A single vehicle crossing or A pair of vehicles is preferred
4	The acceleration data must include measurements in a direction that is nearly normal(perpendicular) to the bridge deck's travel plane.	—

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