

Staged-construction analysis of two-span precast-girder bridge

Test Problem	
Name:	Staged-construction analysis of two-span precast-girder bridge
Description:	Modeling and construction stage analysis of precast-girder bridge which is simply supported for dead load and continuous for live load.
Program:	CSiBridge
Version:	18.1.1
Model ID:	1407

On this page:

- [Overview](#)
- [Model description](#)
 - [Key steps for setting up the model](#)
 - [Modeling comments](#)
- [Discussion of results](#)
- [Attachments](#)

Overview

The purpose of this model is to illustrate how to set up staged construction for a two-span precast girder bridge that is simply supported for dead loads and continuous for live loads. Since the main focus is on setting up the [staged construction](#) load case, no tendons have been added to the model for simplicity.

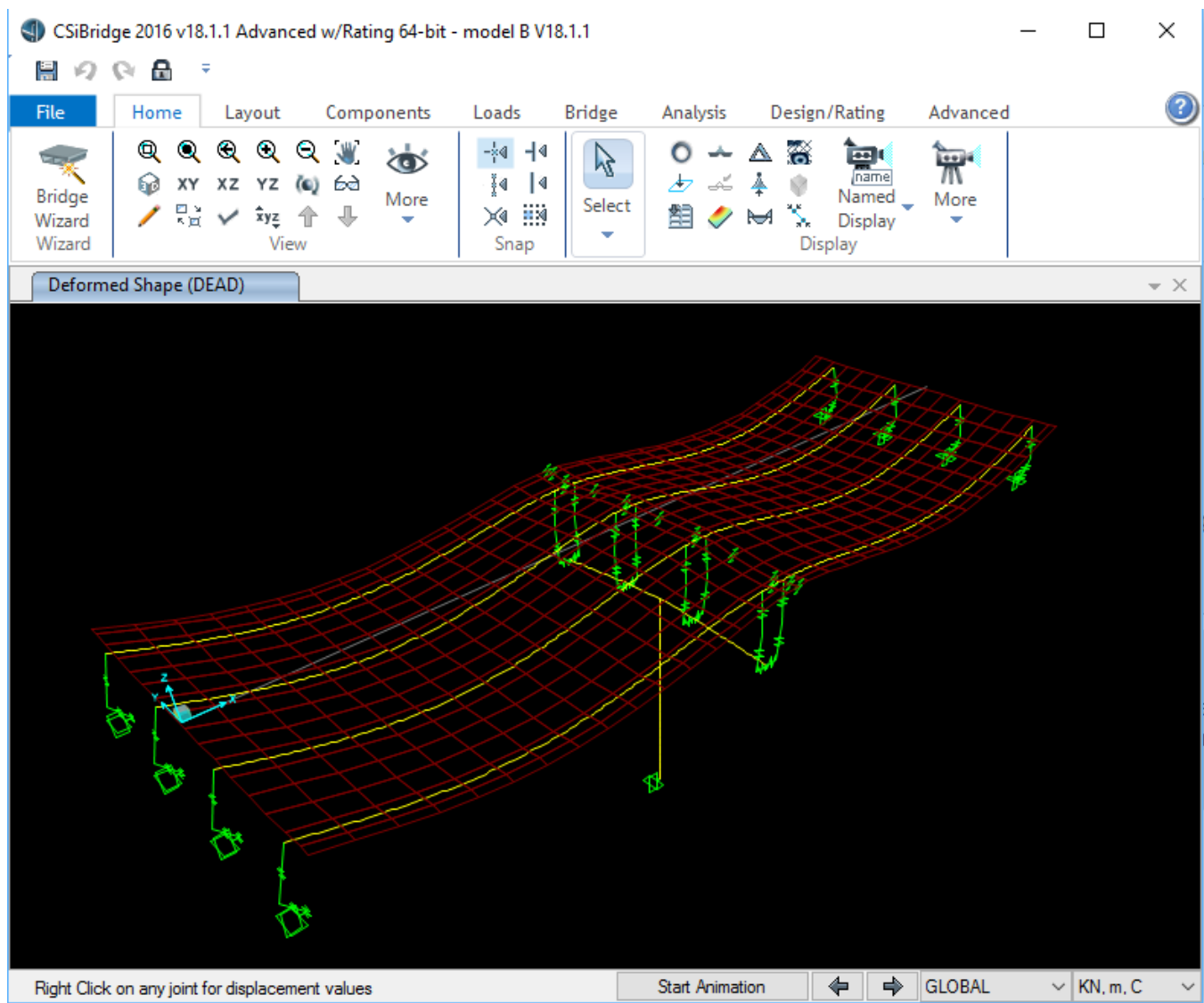


Figure 1: Deflection of the structure under self-weight

Model description

Key steps for setting up the model

- Use the Quick Bridge template to create a 2-span precast-girder bridge. Designate double bearings at the interior pier.
- [Manually](#) define 15 continuity [links](#) at the interior pier to connect the girders and deck between span 1 and span 2. Note the the continuity links have zero length, because they are drawn between two joints that share the same location. These joint are however not connected, because they have different merge numbers.
- Use the "Bridge Tab > Bridge Objects > Groups" menu command to create two [bridge groups](#), one for the deck and the other for the rest of the structure.
- Select the continuity link elements and use "Advanced Tab > Define > Groups" menu command to create group for the continuity link elements.
- Use the "Advanced Tab > Define > Named Property Sets > Area Modifiers" command to define two sets of property modifiers for the deck [shell](#) elements to simulate wet concrete with zero stiffness and full weight and hardened concrete with full stiffness and weight.
- Use "Analysis Tab > Load Cases > New" to set up construction stage analysis with separate stages to:
 1. Add the girders and apply their self-weight
 2. Add deck shell elements
 3. Reduce the stiffness of deck shell elements to simulate wet concrete
 4. Apply the deck self-weight
 5. Reset the stiffness of the deck shell elements to full stiffness to simulate the hardening of concrete
 6. Add continuity links to the model to model continuous superstructure for subsequent loading, such as moving loads
- Save the results at the end of each stage.
- Define [moving-load](#) analysis, starting from the end of [staged-construction](#) analysis.

Modeling comments

- The bridge has fixed bearings at the bent which restrain vertical, longitudinal, and transverse translation. Sliding bearings at the abutments restrain vertical and transverse translation. For all other bearing DOF, **it is necessary to add small stiffness** to stabilize the girder before the deck is erected, otherwise stability problems may occur.

Discussion of results

- Check bridge forces and stresses for each step of the staged construction analysis to ensure that moments are as expected for a simply-supported condition, see Figure 2.
- Check moments for the results of moving-load analysis to ensure that moments are as expected for a continuous-girder system, see Figure 3.
- Since the deck self-weight is applied when the deck has negligible stiffness (to model wet concrete), the deflections of the deck itself in the staged construction are exaggerated and do not represent the true deck deflections. In the actual structure, the wet concrete would be supported by forms that will provide sufficient stiffness. However, the stiffness of the forms has not been modeled in this model.

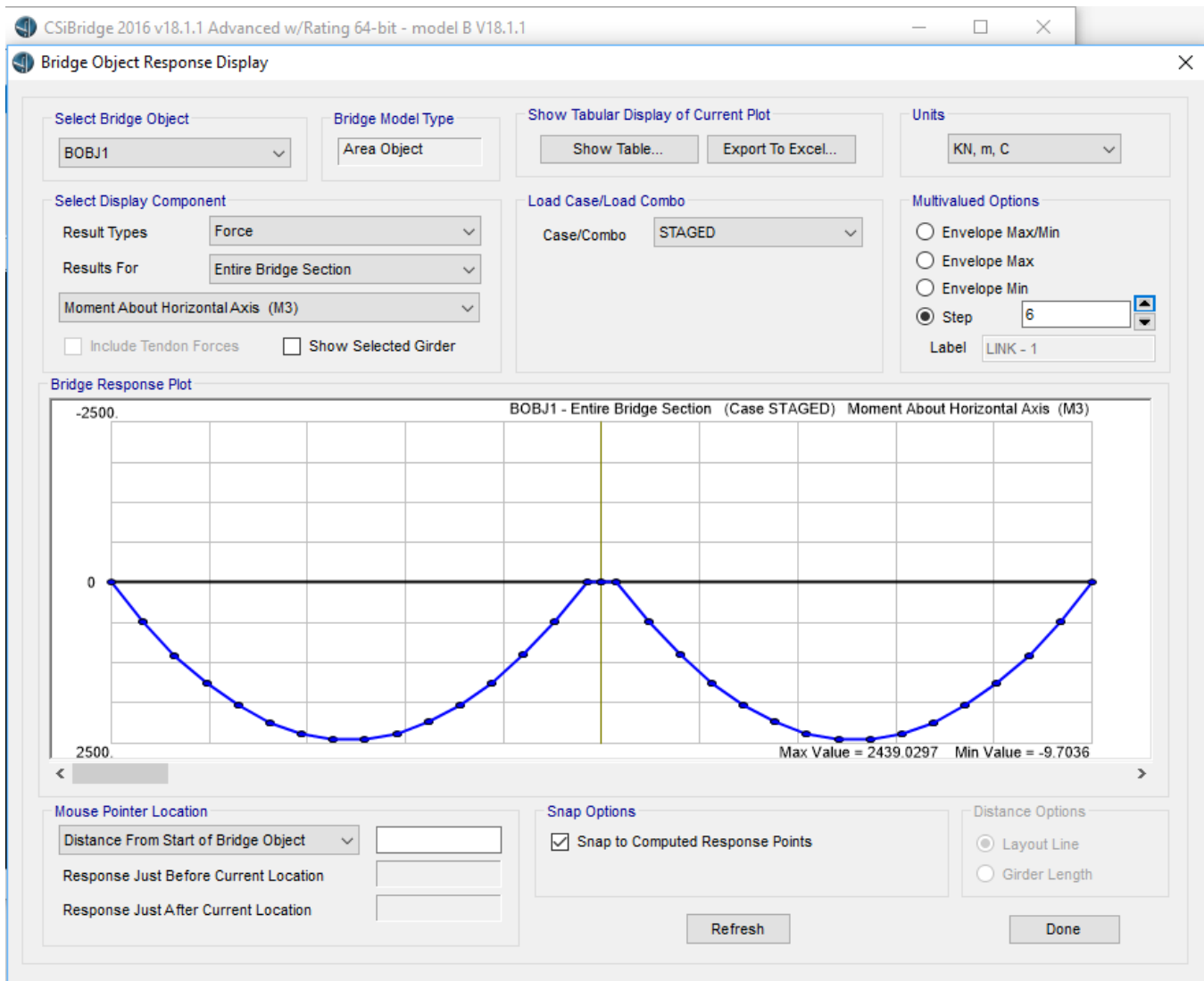


Figure 2: Moment diagram at the end of staged construction (simply supported superstructure)

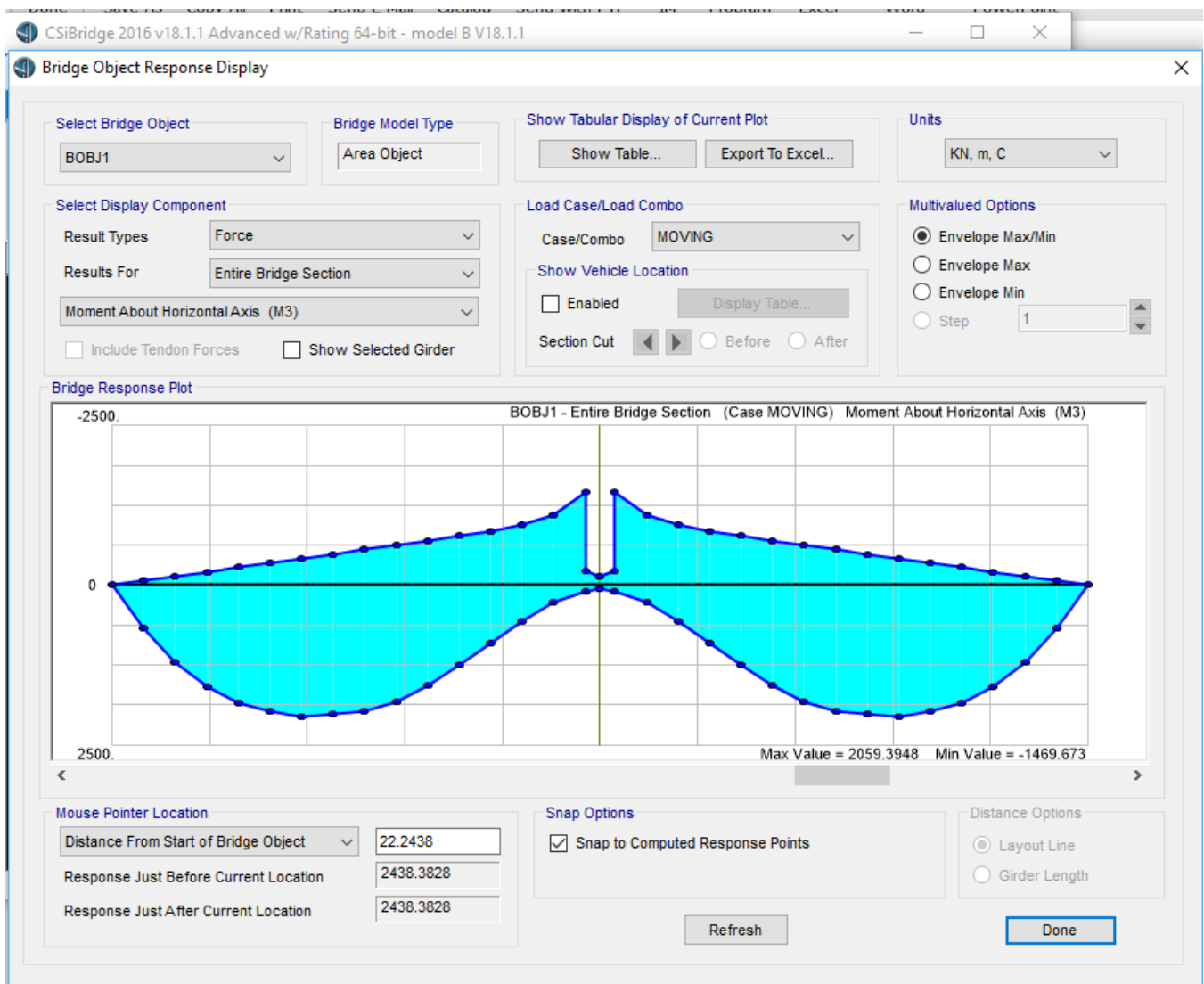


Figure 3: Live load moment diagram (continuous superstructure)

Attachments

- [model B V18.1.1.zip](#) (zipped CSiBridge.BDB file)