Suspension bridge

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How are suspension bridges and cable forces modeled and analyzed?

**Answer:** Suspension bridges may be modeled and analyzed in SAP2000 through either of the following methods:

- **Staged construction,** which simulates the construction sequence.
- **Direct solution of the deformed equilibrium configuration under dead load.**

Once bridge stiffness under dead load is obtained, additional analyses (moving-load, wind, seismic, etc.) may be performed using the stiffness at the end of the dead load case.

**Detailed staged-construction analysis**

To perform the staged-construction analysis of a suspension bridge, create a staged-construction load case which reflects the erection sequence from foundation construction through pylon, main-cable, suspender, and deck assembly.

**Solve for deformed equilibrium configuration**

When deformed configuration is derived through input parameters (main cable sag, main cable span, deck profile, etc.), the corresponding force values may be obtained using SAP2000. Analysis may begin with coordinates which specify the final deflected shape. The cable load which corresponds to the final deformed configuration should be specified in the Cable Geometry menu. This cable load can be estimated from the weight of the structure and its distribution along the bridge.

After analysis, joint coordinates should be modified through Analyze > Modify Undeformed Geometry such that deflected shape at the end of staged construction matches the geometry initially specified. Several iterations may be necessary for convergence to the desired shape.

**See Also**

- Accounting for deformed shape in staged construction article

**References**