allanlzee / civ102-bridge Public

Automated beam bridge analyzer determining maximum loads.

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README

Beam Bridge Analyzer

This project automates the calculations for a beam bridge of any cross section carrying a train of known load. The project was designed to eliminate the amount of time spent on hand calculations to focus on optimizing the cross section of the bridge to carry higher loads.

Using Shear Force Diagrams and Bending Moment Diagrams generated by the program for all 1200 possible train locations (the bridge is 1200 mm in length), the program analyzes:

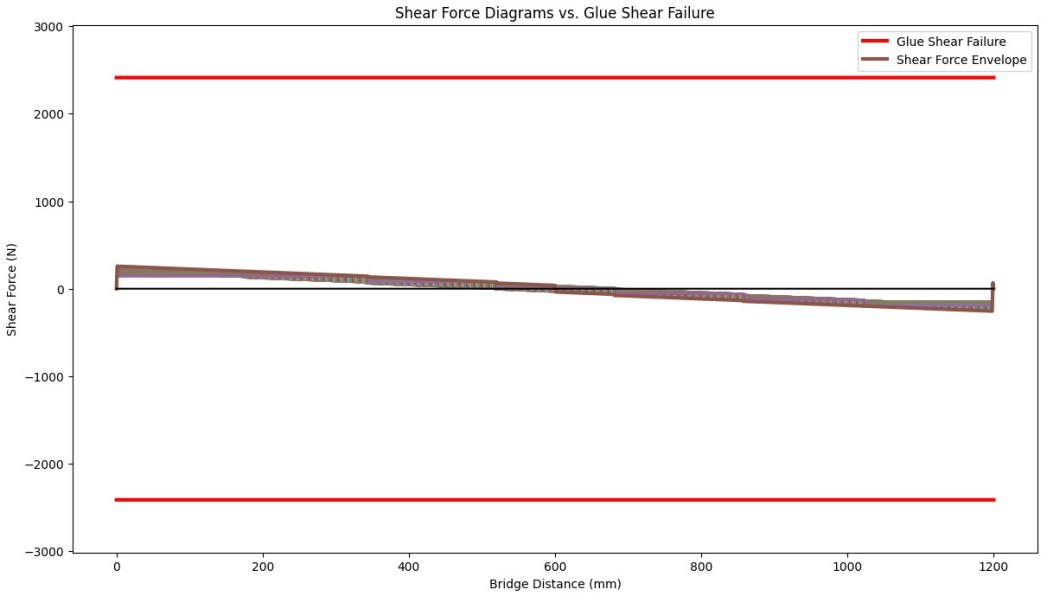
- Compressive Stress

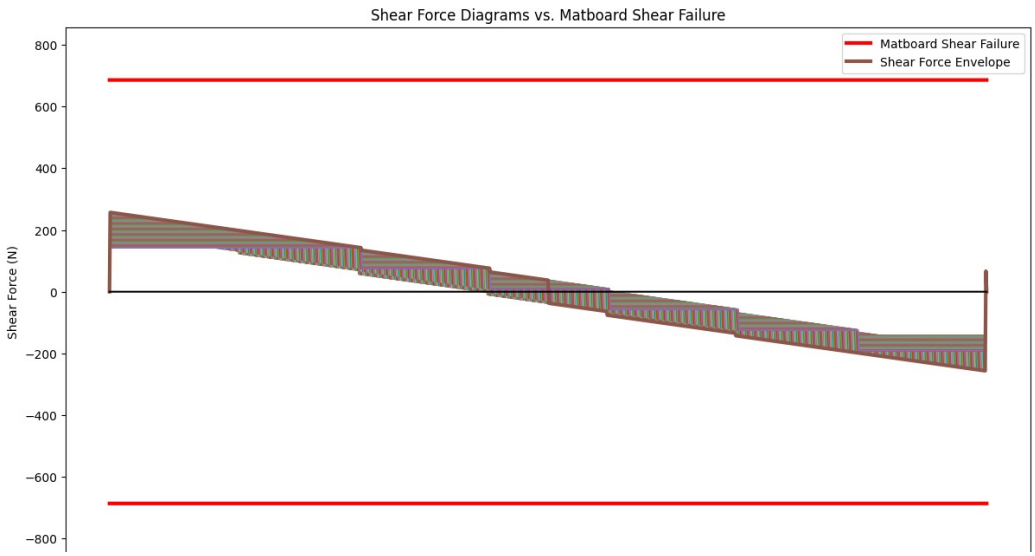
- Tensile Stress
- Thin Plate Buckling (multiple modes)
- Shear Stress of Bridge and Glue
- Factors of Safety (based on material properties)
- Theoretical Method of Failure

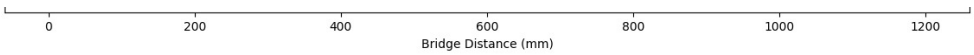
Visuals

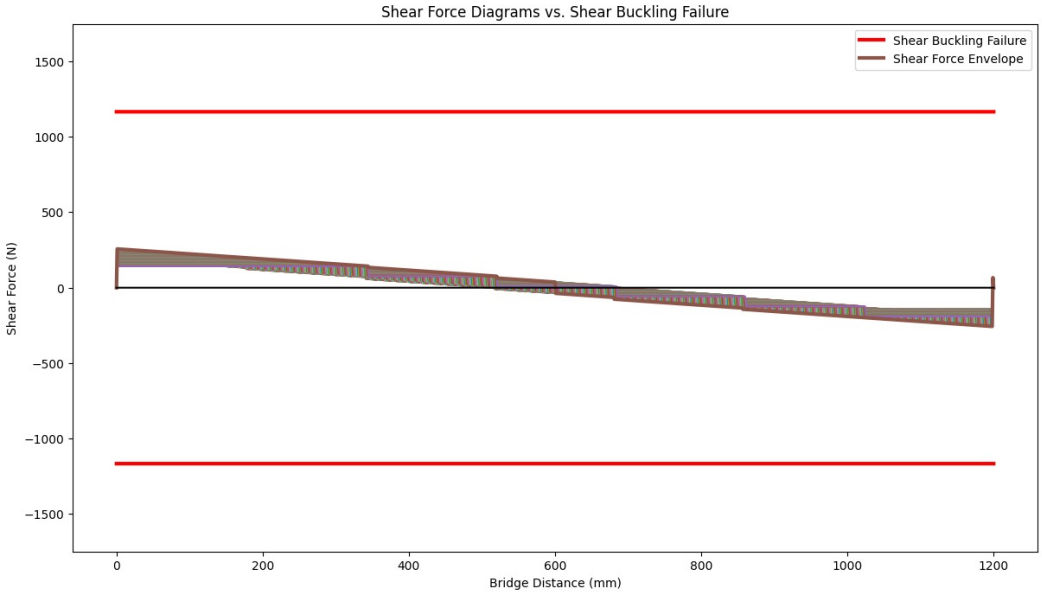
The project uses several Python libraries to visually represent each possible mode of failure for the bridge. The following graphs are for a 400 N train.

Shear Force Diagrams

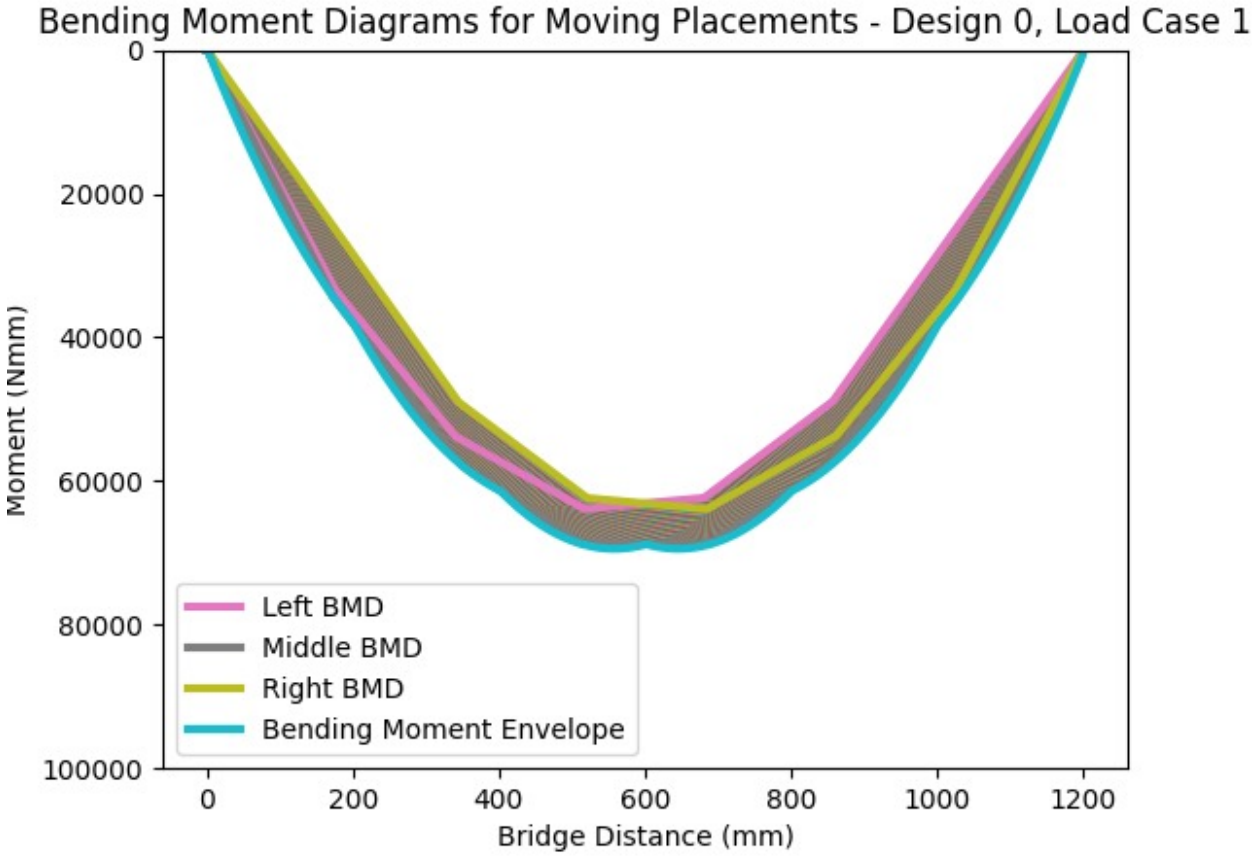


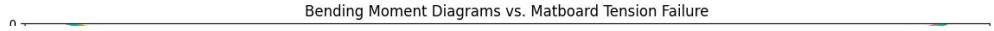


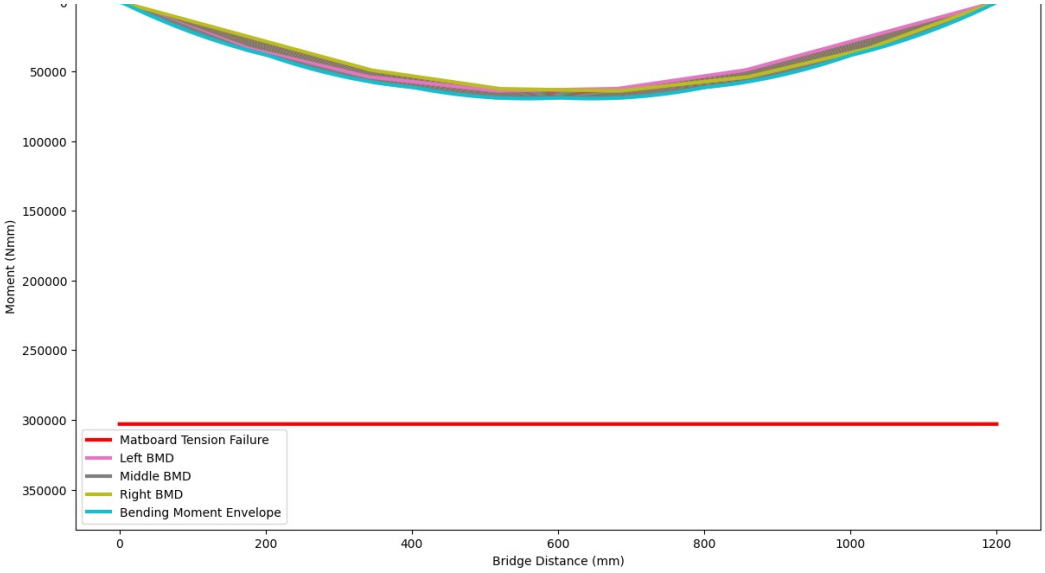


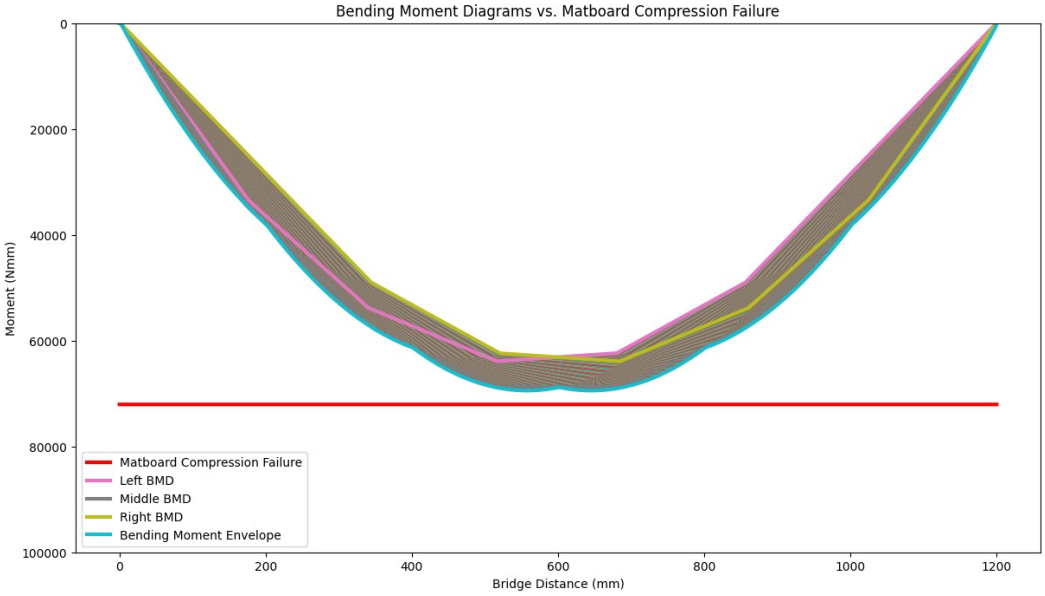


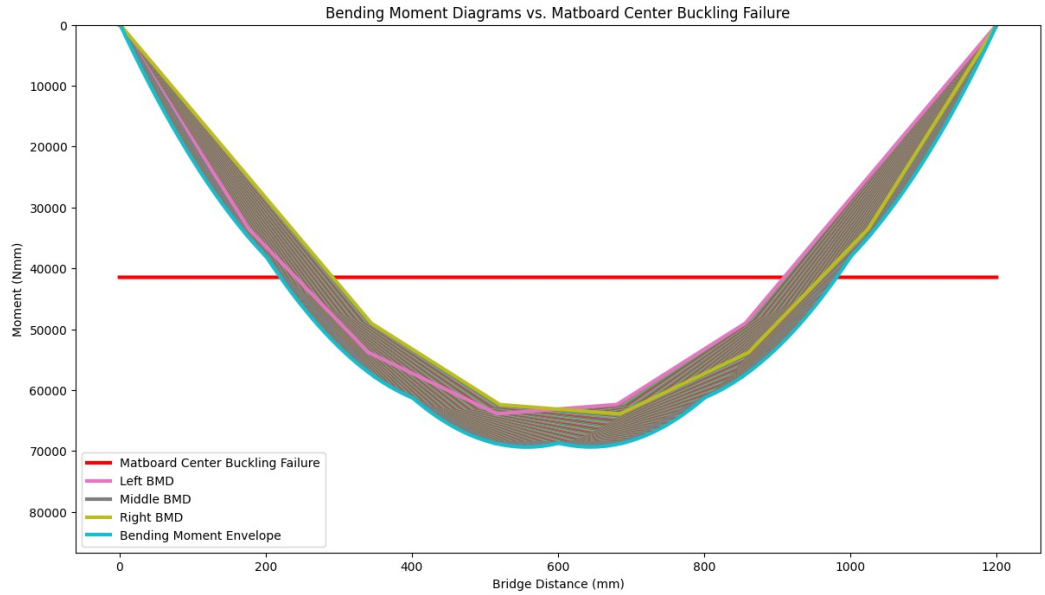
Bending Moment Diagrams

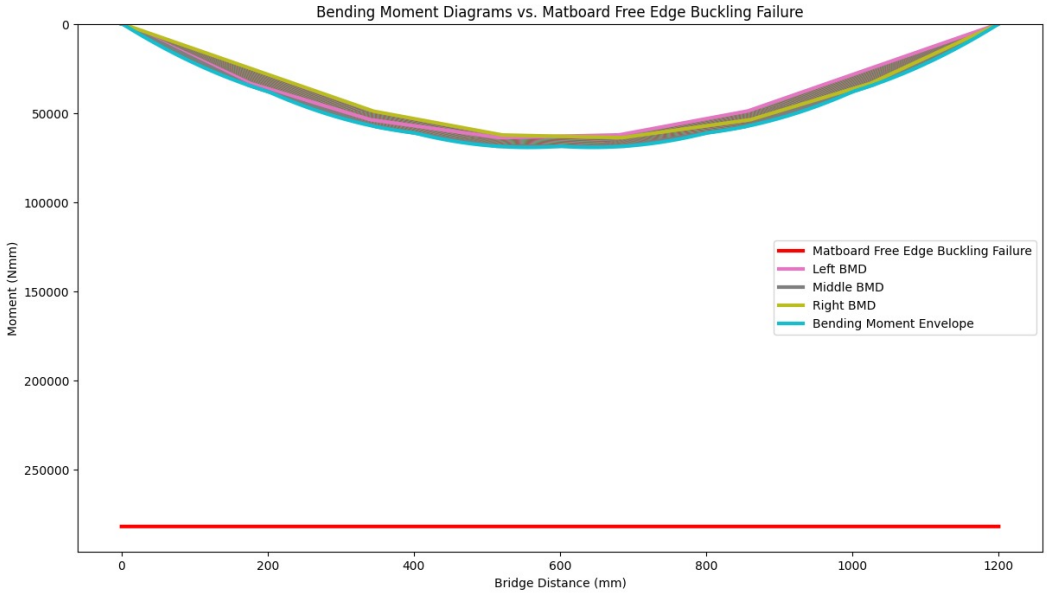


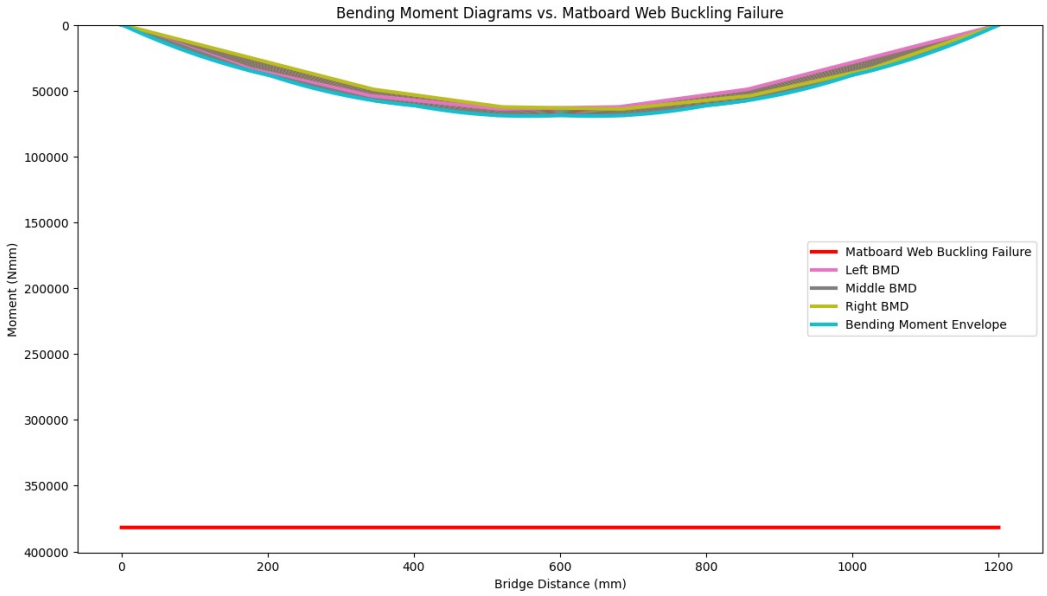



50000
100000
150000
200000
250000
300000
350000
Moment (Nmm)
Matboard Tension Failure
Left BMD
Middle BMD
Right BMD
Bending Moment Envelope
0
200
400
600
800
1000
1200
Bridge Distance (mm)


Bending Moment Diagrams vs. Matboard Compression Failure
0
20000
40000
60000
80000
100000
Moment (Nmm)
Matboard Compression Failure
Left BMD
Middle BMD
Right BMD
Bending Moment Envelope
0
200
400
600
800
1000
1200
Bridge Distance (mm)


Bending Moment Diagrams vs. Matboard Center Buckling Failure
0
10000
20000
30000
40000
50000
60000
70000
80000
Moment (Nmm)
Matboard Center Buckling Failure
Left BMD
Middle BMD
Right BMD
Bending Moment Envelope
0
200
400
600
800
1000
1200
Bridge Distance (mm)





Instructions for Use

To obtain the factors of safety based on the bending moment diagram and shear force diagram, run **main.py**.

To obtain graphical representations of the bridge capacities, run **capacities.py**.

Releases

No releases published

Packages

No packages published

Languages

- **Python** 100.0%