University of Toronto
CIV 102 Bridge Design Delivery 1

Jingfei Liu, Stella Yuan, Xuanhao Lu

November 13th, 2023

1 Shear Force Diagram(SFD)&Bending Moment Diagram(BMD)

The following FBD, SFD, and BMD is obtained by hand calculation and verified and drawn by matlab script.

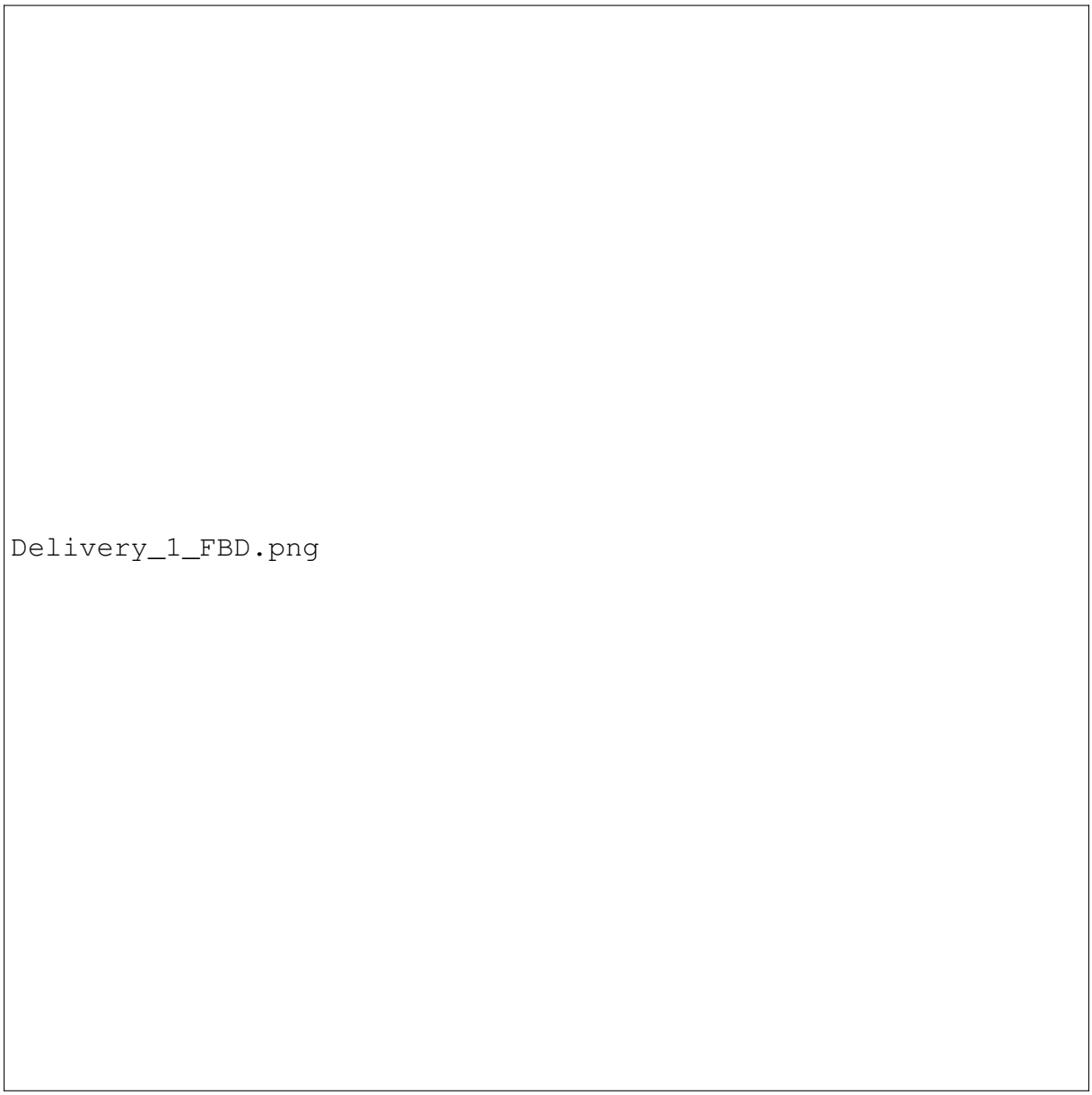

Figure 1.1: This is the FBD for the base case of load condition 2

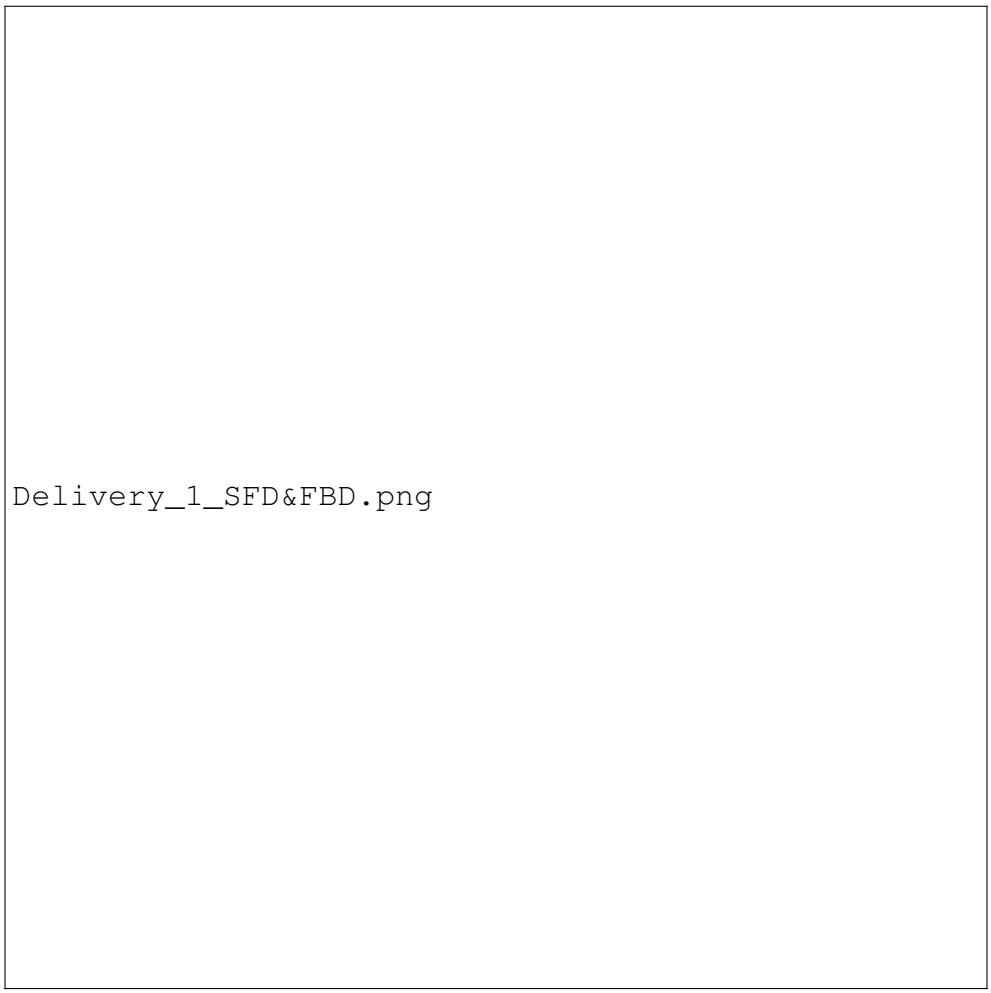

Figure 1.2: This is the SFD and the BMD for the base load of condition 2

2 FOS

The following results are obtained from calculations done by hand and verfied by Excel. The max monments are obtained from the max value of BMD. The equation used is

$$\sigma = \frac{My}{I} \tag{1}$$

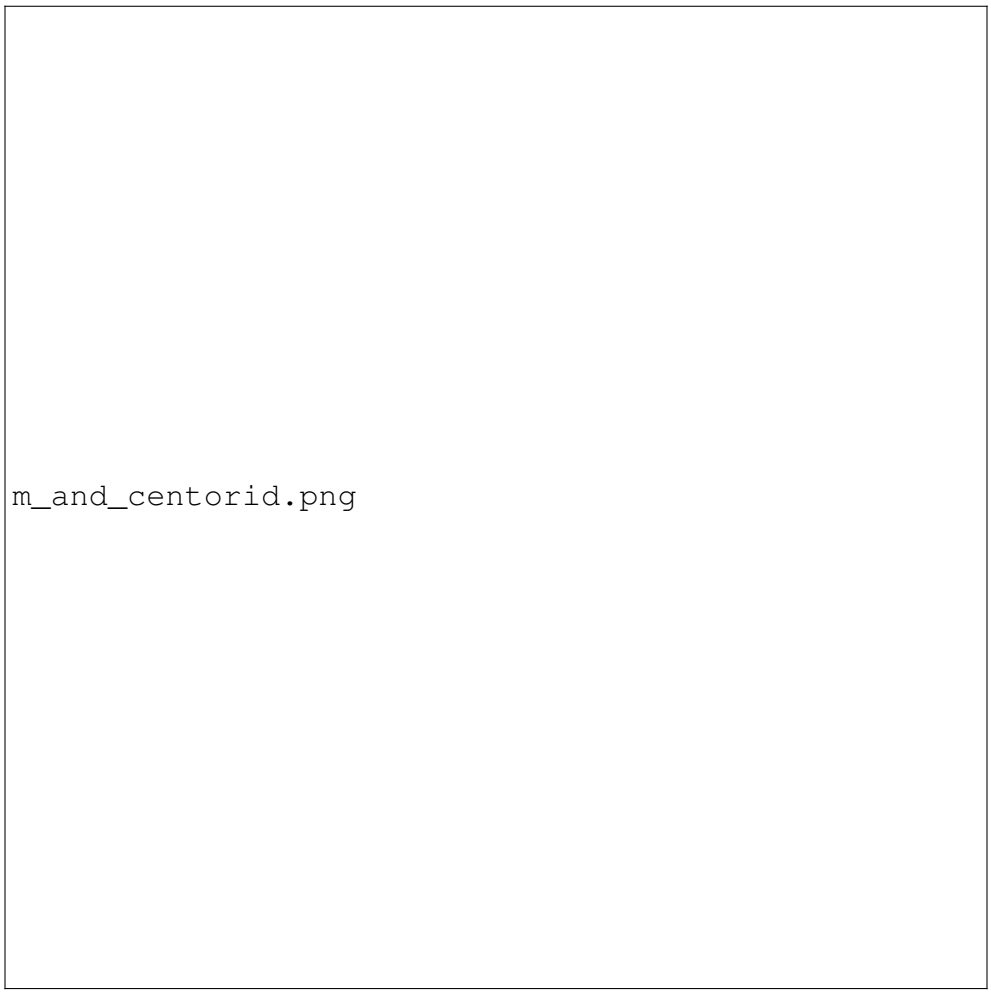

Figure 2.1: This is the data calcualted for FOS obtained from excel

The maximum moment is $8.39 \times 10^4 N * mm$.

The distance from the top of the beam to the centorid is $y_{top} = 76.27mm - 40.15m = 36.12mm$.

The maximum flexural tension is thus $\sigma_{max,top} = \frac{(8.39 \times 10^4 N*mm)(36.12mm)}{419178.6627mm^4} = 7.23Mpa$.

The distance from the bottom of the beam to the centorid is $y_{bottom} = \bar{y} = 40.15mm$.

The maximum flexural compression is thus $\sigma_{max,bottom} = \frac{(8.39 \times 10^4 N*mm)(40.15mm)}{419178.6627mm^4} = 8.04Mpa$.

The FOS for flexural tension is $FOS_{tension} = \frac{\sigma_{max}}{\sigma}$, which is then $FOS_{tension} = \frac{30Mpa}{7.23Mpa} = 4.15$.

The FOS for flexural compression is $FOS_{compression} = \frac{\sigma_{max}}{\sigma}$, which is then $FOS_{compression} = \frac{6Mpa}{7.23Mpa} = 0.830$.