University of Toronto
CIV 102 Bridge Design Delivery 1

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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.
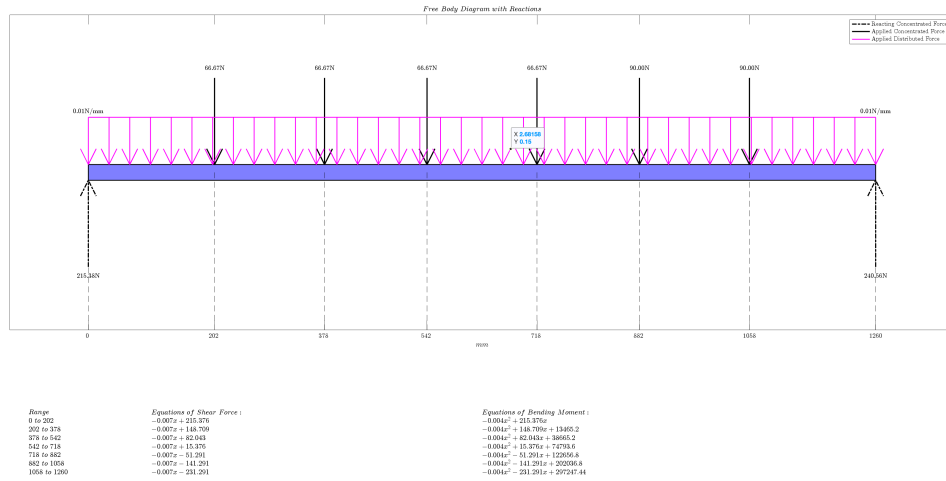

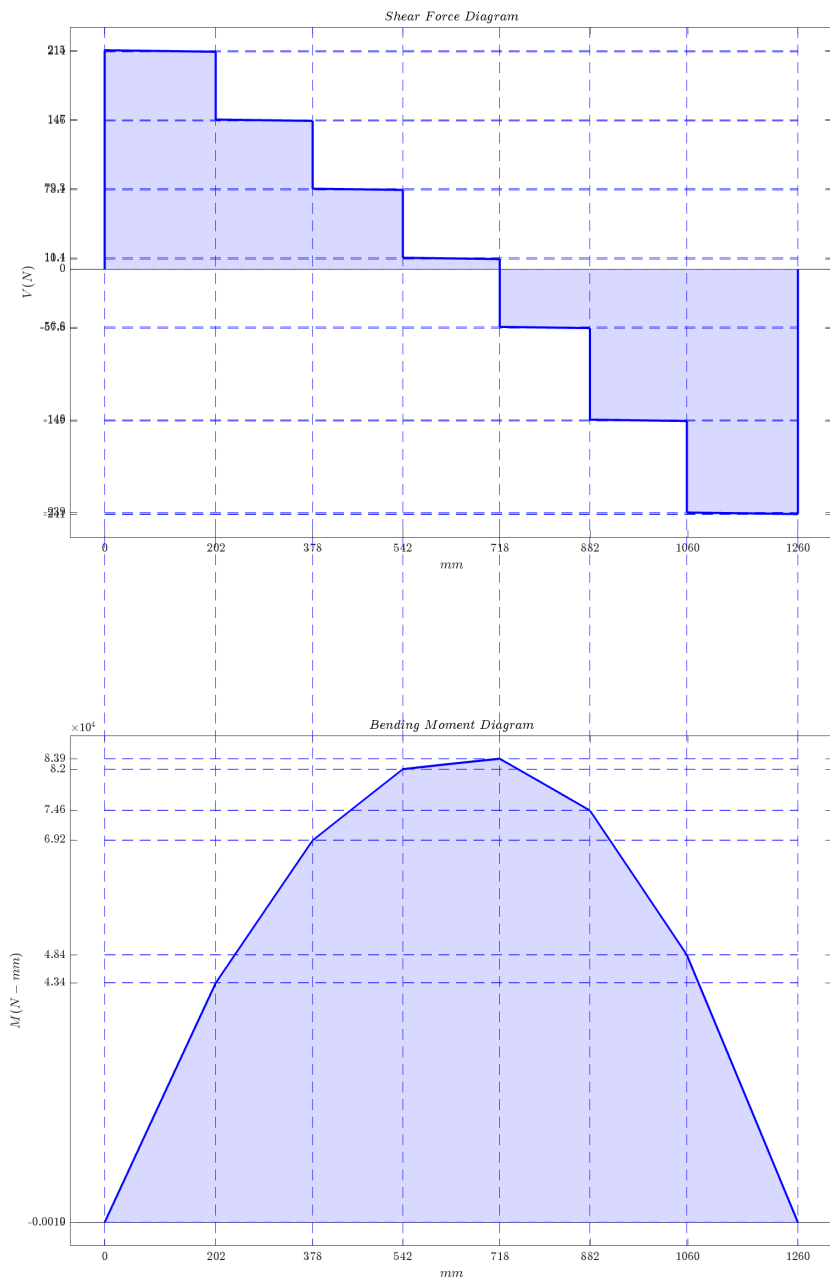**Figure 1.1:** This is the FBD for the base case of load condition 2

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

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

	Corss section	Area(mm^2)	y(mm)	h(mm)	b(mm)	I_0(mm^4)	I(mm^4)
1							
2	1	127	75.635	1.27	100	17.06986	151015.7
3	2	12.7	74.365	73.73	1.27	84836.97	98845.02
4	3	187.2742	37.5	1.27	10	1.706986	2501.616
5	4	101.6	0.635	1.27	80	13.65589	166816.3
6		y_bar	41.15362			84869.41	419178.7

Figure 2.3: 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 $FOS = \frac{30Mpa}{7.23Mpa} = 4.15$.
The FOS for flexural compression is $FOS_{tension} = \frac{\sigma_{max}}{\sigma}$, which is then $FOS = \frac{6Mpa}{7.23Mpa} = 0.830$.